Utilization of Health Care Services and Health Status of Transgender Clients at a NYC Community Health Center

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Abstract

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In 2011 the National Academy of Medicine identified research gaps related to transgender populations and suggested a research agenda that included, among other goals, investigating health outcomes related to transition related care. The overarching goal of this dissertation therefore is to add to the body of knowledge about the state of health of transgender individuals, including utilization of gender-affirming care, preventive care and screening practices for human immunodeficiency virus (HIV) and other sexually transmitted infections (STIs).

This dissertation includes three manuscripts. The first is a retrospective chart review including 1670 transgender patients, aged 18 and up (mean age 35.57 years), at a community health center to examine utilization of gender-affirming procedures as well as investigate the prevalence of smoking and uptake of colon cancer screening compared to New York City benchmarks using data from the New York City Community Health Survey (NYC CHS). The results revealed transgender individuals had high uptake of gender affirming hormones (81.9%) but fewer had undergone gender-affirming surgeries (31.5%). Transgender individuals had almost double the rate of current cigarette smoking compared to adults aged 18 and up in the New York City Community Health Survey (OR=1.92, 95% CI=1.61, 2.28) and also had suboptimal colon cancer screening rates compared to New Yorkers aged 50 and older (OR=0.16, 95% CI=0.11, 0.23).

The second paper is a scoping review of the literature to investigate postoperative outcomes related to vaginoplasty procedures in transgender women. One hundred and three articles met inclusion criteria and provided information on immediate as well as long term health outcomes. The review demonstrated many inconsistencies in the timing of follow-up as well as how outcomes were measured, but provided invaluable information on the many types of postoperative issues that may be seen after vaginoplasty surgery.

Lastly, the third paper examined the prevalence of HIV and STI testing behavior and prevalence of HIV infection among transgender people in a community health center setting. This analysis demonstrated that HIV screening rates were lower than expected (55.7%) given the elevated HIV prevalence in the population. In the multivariate analysis the odds of HIV screening among transmasculine individuals was higher in those who had undergone gender affirming surgeries (OR=1.67, 95% CI= 1.08, 2.58), had a substance use history (OR=5.18, 95% CI=1.41, 18.99) and a history of genital warts (OR=4.64, 95% CI=1.24, 17.34). Among transfeminine individuals the odds of HIV screening were higher in those with only cisgender male partners (OR=2.18, 95% CI=1.52, 3.11), gender affirming surgery (OR=2.56, 95% CI=1.53, 4.31), substance use history (OR=2.76, 95% CI=1.23, 5.78) and genital warts (OR=2.69, 95% CI=1.20, 6.02). HIV prevalence was higher among transfeminine compared to transmasculine individuals (28.1% vs. 2.8%, p<.001). In the multivariable analysis having only cisgender male sex partners increased the odds of HIV infection among transmasculine individuals (OR=10.58, 95% CI=1.33, 84.17), while having at least a high school diploma reduced the odds of infection (OR=0.08, 95% CI=0.01, 0.72). Among transfeminine individuals increased odds of HIV-infection were seen in those who were unemployed (OR=1.7, 95%

CI=1.1, 2.64) and those who had a history of genital warts (OR=2.54, 95% CI=1.37, 4.70). White individuals had a lower likelihood of HIV infection (OR=0.40, 95% CI=0.21, 0.73).

Overall these three studies provide important information about transition-related, primary and preventive healthcare for transgender populations. The findings of elevated cigarette smoking, underutilization of colorectal cancer screening and low HIV and STI screening rates occurred in this study despite the fact that transgender people were engaged in medical care. Clinics and other health settings that provide transgender health services should include robust metrics for monitoring uptake of preventive health care services and work to improve uptake of services when disparities are evident.

Table of Contents

List of Figures and Tables iii

Acknowledgments v

Dedication vi

Chapter 1: Introduction & Overview of the Dissertation 1

1.1 Utilization of Gender Affirming Care and Preventive Care by Transgender Individuals 3

1.2 A Scoping Review of Vaginoplasty Surgery Outcomes 4

1.3 HIV and STI Prevalence among Transgender People 5

Chapter 2: Utilization of Gender Affirming Care and Preventive Care by Transgender Individuals 8

2.1 Introduction 8

2.2 Methodology 10

2.3 Results 23

2.3 Discussion 37

2.4 Conclusion 42

Chapter 3: Health Outcomes of Transgender Women who have Undergone Vaginoplasty Surgery: A Scoping Review 43

3.1 Background 43

3.2 Methods 47

3.3 Results 50

3.4 Discussion 69

3.5 Conclusions and Recommendations 72

Chapter 4: Sexually Transmitted Infections among 74

Transgender People 74

4.1 Background 74

4.2 Methods 78

4.3 Results 80

4.4 Discussion 100

4.5 Conclusion 105

Chapter 5: Dissertation Summary and Conclusions 106

References 113

List of Figures and Tables

Chapter 1

Figure 1: Theoretical relationships between stigma, gender affirming care and health outcomes

Chapter 2

Figure 1: Examples of gender identity listed in the social history template

Table 1: Variables used from the New York City Community Health Survey

Table 2: Description of gender identity categories used in the study

Table 3: Documentation of gender identity in electronic health records

Table 4: Other Gender Identities

Table 5: Demographics, tobacco, substance use and colonoscopy rates among transgender patients

Table 6: Gender affirming care and gender identity

Table 7: A comparison between demographic variables and health factors in the NYC CHS and transgender people at CLCHC

Table 8: Demographics and colon cancer screening (colonoscopy) among transgender patients and respondents of the New York City Community Health Survey 2011 ≥age 50 (n=4800): bivariate and multivariate logistic regression models

Table 9: Demographics and cigarette smoking among transgender patients and respondents of the New York City Community Health Survey 2011 (n=9449): bivariate and multivariate logistic regression models

Chapter 3

Figure 1: Flowchart of articles selected for inclusion in scoping review.

Figure 2: Publications by Year 1970-2018

Figure 3: Publications by Country

Table 1: Search terms used for the database search

Table 2: Vaginoplasty Outcome Measures

Table 3: Perioperative Vaginoplasty Complications Reported

Table 4: Summary of Case Reports

Table 5: Prospective Studies: Outcome measures

Chapter 4

Figure 1: HIV Prevalence by Race/ethnicity

Table 1: Documentation of gender identity in electronic health records

Table 2: Demographic and other socioeconomic variables among transgender patients

Table 3: Gender identity and gender of sex partner*

Table 4: HIV and STI risk factors, screening and prevalence among transgender patients

Table 5: HIV status by gender identity and gender identity of sex partners

Table 6: Gender affirming care and gender identity

Table 7: Vaginoplasty and STI prevalence

Table 8a: HIV screening: Bivariate and multivariable logistic regression models and transmasculine individuals

Table 8b: HIV screening: Bivariate and multivariable logistic regression models and transfeminine individuals

Table 9a: HIV Prevalence: Bivariate and multivariable logistic regression models and transmasculine individuals

Table 9b: HIV Prevalence: Bivariate and multivariable logistic regression models and transfeminine individuals

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Dedication

This dissertation is dedicated to the memory of my grandparents

Chapter 1: Introduction & Overview of the Dissertation

Transgender individuals are those whose gender identities do not align with their assigned sex at birth. The term transgender is considered by many to be an "umbrella" term that includes those with binary identities, e.g., transgender men and women as well as those who identify outside of the binary; gender non-binary, gender nonconforming, genderqueer, agender and bigender among others. The adult transgender population in the United States is estimated to be between 1 and 1.4 million[1, 2] and includes those who have, or intend to undergo medical and/or surgical transition to their affirmed gender, as well as those who do not wish to undergo any type of gender affirming procedures.[3-5] Transition refers to the process of changing gender roles or expression to one that aligns with most closely with one's gender identity. This may include social transition (e.g., changing names, pronouns, clothing), legal, medical and surgical interventions.[6, 7]

The diverse experiences of transgender persons, whether assigned male or female at birth, their sexual orientation, whether they are hormone experienced or not and whether they have undergone transition related surgeries, present particular challenges to researchers in determining the impact of gender identity on health outcomes. In addition, since there are no US population-based surveys that include gender identity as a demographic variable, it is not possible to fully investigate the health care needs of transgender people. The National Academy of Medicine in its Report "The Health of Lesbian, Gay, Bisexual, and Transgender People: Building a Foundation for Better Understanding" stated that all aspects of research related to transgender-related care needed to be prioritized.[8]

Transgender people often experience high rates of stigma, socioeconomic and structural barriers to care that negatively impact healthcare utilization, increase susceptibility to human

immunodeficiency virus (HIV) and sexually transmitted infections (STIs) and incur missed opportunities for HIV and STI prevention services.[9-16]. Transgender women carry elevated risk factors for HIV and other STIs including high rates of sex work (often exceeding 50%), condomless anal receptive sex, early sexual debut and high numbers of predominately cisgender men sexual partners. [17-23]. Several studies reveal that the incidence and prevalence rates of human immunodeficiency virus (HIV) among transgender women surpass those reported among cisgender men who have sex with men (MSM).[19, 24-30] The rates of HIV in the USA are even more concerning among transgender women of color, reaching prevalence in some studies of over 50%.[19, 24, 31] Despite an increase in research conducted in transgender populations over the last decade, the majority of these studies have been small non-random surveys using convenience samples with a focus on HIV and STI risk [27, 32, 33] Additionally, most studies have examined risk among transgender women while only a few have examined HIV in transgender men, despite the fact that transgender men often have HIV risk factors such as engaging in sex work, condomless sex with cisgender men and low rates of STI screening. [15, 34-37] There has also not been risk stratification among transgender populations, e.g., examining the HIV risk for transgender people who have sex with cisgender women vs. cisgender men.

There are no large-scale population-based studies and consequently few data on general health issues that affect the transgender population at large, such as rates of obesity, tobacco use, cardiovascular disease and cancer.[8, 33] In addition, there are few data on the community's utilization of preventive health services, such as screenings for cancer and diabetes, although data exist that transgender persons are less likely to undergo preventive health screenings or to be aware of their HIV status, despite being among the highest risk groups.[19, 32, 33, 38-40]

Transgender women who receive gender affirming hormone therapy (GAHT) often use the same types of estrogens as postmenopausal women whereas transgender men use testosterone preparations that are dosed similarly to those used for the treatment of cisgender men with hypogonadism.[41] Research on the mental health effects of GAHT has found that transgender people experience improvements in psychosocial functioning and quality of life and experience lower rates of anxiety and depression.[42-44] Research on the medical outcomes of GAHT have focused mainly on investigating metabolic effects and adverse outcomes, such as dyslipidemias, venous thromboembolism, bone health, cardiovascular and cancer risk.[6, 41, 45-48]. There is emerging evidence that receipt of GAHT may mediate the effects of transgender discrimination, leading to improved rates of viral suppression among transgender women living with HIV.[49] There have been no studies examining the indirect effects of GAHT on primary care parameters, e.g., whether access to hormones is associated with uptake of preventive care, such as improvements in STI, HIV or cancer screenings or reductions in unhealthy behaviors such as tobacco or substance use. Therefore, the overarching goal of this dissertation is to add to the body of knowledge about the state of health of transgender individuals.

1.1 Utilization of Gender Affirming Care and Preventive Care by Transgender Individuals

The ***first specific aim*** of this dissertation is to describe the utilization of transition (GAHT and gender affirming surgery), preventive care (colonoscopy) and health behaviors (tobacco use) by gender identity among transgender patients at a New York City Community Health Center (Chapter 2). The hypothesis is that uptake of preventive health services (colon cancer screening) by transgender clients attending a New York City Health Center is lower than that reported for

cisgender populations in New York City and that cigarette smoking rates will be higher among transgender compared with cisgender population.

Rationale: Few studies have examined rates of uptake of preventive health services among transgender clients, since gender identity has not been included in the majority of national health surveys. As described above, the identification of transgender persons is challenging for researchers as there is considerable diversity both in terms of gender identity as well us use of gender affirming care and this diversity is likely to influence utilization of healthcare services. This study was designed to address gaps in knowledge by comparing the uptake of preventive health services between transgender women and transgender men clients compared to benchmarks from the 2010 New York City Community Health Survey. Colon cancer screening was chosen to examine cancer screening rates as all people ages 50 and over, whatever their birth sex, surgery or hormone status, should still follow standard colon cancer screening guidelines.

1.2 A Scoping Review of Vaginoplasty Surgery Outcomes

The ***second specific aim*** is to summarize what has been published about genital surgery (vaginoplasty) in transgender women, including a description of different surgical techniques, quality measures, postoperative complications and long-term health outcomes (Chapter 3).

Rationale: The proportion of genital surgeries has increased over the last 2 decades in part due to changes in health insurance laws that now include reimbursement for gender affirming care. Several narrative and systematic reviews [47, 48, 50-53] have examined long-term health outcomes related to cross-sex hormone therapy; however, to our knowledge, although there have been systematic reviews of surgical techniques, short term health outcomes and a recent review of outcome measures,[54-57] there have been no comprehensive reviews investigating short and long-term health outcomes related to these surgeries for transgender women who have undergone

genital surgery. Aggregating existing research and identifying gaps in knowledge will be useful for clinicians providing primary care and surgeons, inform future research, as well as assist policy makers seeking to create quality measures for care of transgender people

1.3 HIV and STI Prevalence among Transgender People

The ***third specific aim*** is to describe the prevalence of HIV and sexually transmitted infections (STIs) among transgender clients attending a New York City Health Center and to investigate HIV and STI screening practices (Chapter 4).

Hypothesis 1: There will be distinct differences in the prevalence of HIV and STIs between transgender men and transgender women

Hypothesis 2: The gender of sex partners will have an impact on the prevalence of HIV and STIs in both transgender men and transgender women

Hypothesis 3: The third hypothesis is that patients who access gender affirming care will be more likely to undergo screening for HIV and STIs

Rationale: A recent systematic review and metanalysis of HIV among transgender women estimates the US prevalence of HIV to be 14% among transgender women with the highest prevalence among black (44%) and Hispanic/Latino (26%) transgender women.[24] Data also suggest high rates of HIV among transgender women globally.[25] The few studies of HIV prevalence and incidence in transgender men suggest that they have a lower prevalence of HIV than transgender women, approximately 2%.[24]

There are limited data both about STI screening behaviors as well as STI prevalence among transgender people of all gender identities, including gender nonbinary people. Gender affirmation has been shown to mediate transgender-related stigma and may result in improved health outcomes.[49] To our knowledge, there are no data on HIV and STI screening practices or

prevalence of infection in transgender people who have received GAHT or undergone gender affirming surgeries.

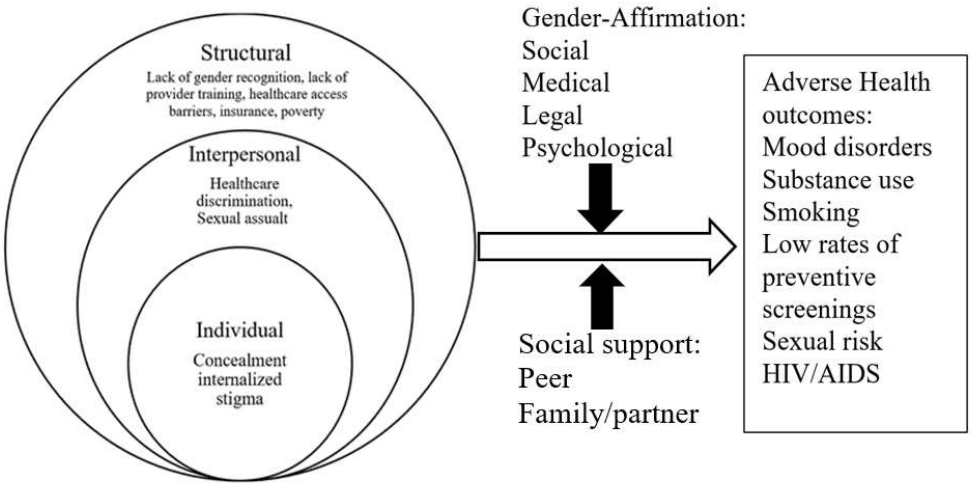
The aim of this report was therefore to examine rates of screening behaviors and prevalence of HIV, syphilis, *Neisseria gonorrhoeae* (GC) and *Chlamydia trachomatis* (CT) and CT infections in transgender people using retrospective chart review data from a community health center in New York City.

The Importance of this Research

Transgender people are understudied and there are large gaps in knowledge about the utilization of both transition-related and non-transition primary health care. It is hypothesized that structural, interpersonal and individual level stigma adversely affect health outcomes for transgender people and that this relationship may be modified by access to gender affirming care (Figure 1). This dissertation provides important information on the uptake of gender-affirming care, both hormones and surgeries by transgender people and the relationship to primary care outcomes. This paper also highlights that transition-specific health outcomes, through the example of vaginoplasty surgery, have not been well studied and that outcome measures are not standardized. Preventive care utilization is often used as a health care quality metric however comparing data between transgender and cisgender populations is hindered by the fact that many healthcare quality indicators are based on birth sex (e.g., breast or cervical cancer screening), and may not be appropriate for those who have undergone surgeries or taken hormones. The dissertation provides meaningful comparisons of preventive care between cisgender and transgender populations using health indicators that can be applied independent of gender identity (colorectal cancer screening, HIV and STI screening, smoking). These identified gaps in measurement will hopefully lead to a new research agenda to identify and develop standardized

and appropriate health outcome measures that can be used to assess interventions in transgender populations.

Figure 1: Theoretical relationships between stigma, gender affirming care and health outcomes



Chapter 2: Utilization of Gender Affirming Care and Preventive Care by Transgender Individuals

2.1 Introduction

Transgender people have a gender identity that differs from the sex that they were assigned at birth.[6, 58] A recent meta-regression analysis indicated that approximately one million adults in the United States (US) aged 18 years and older (0.4% of the adult population) identify as transgender[1] with an estimated 25 million adults worldwide. A higher proportion of youth, almost 2% of high school students, identify as transgender.[59]

Transgender women ("trans women" or "women of transgender experience") are women who were assigned male at birth (i.e., born with male anatomy). Transgender men ("trans men" or "men of transgender experience") are men who were assigned female at birth (i.e., born with female anatomy). Some individuals may identify outside the gender binary of male or female or move back and forth among different gender identities and use terms such as gender nonbinary, genderqueer, gender nonconforming or gender fluid to describe themselves. Agender or null-gender persons do not identify with having any gender. The terms cisgender is used to describe persons who identify with their assigned sex at birth. Although there are no US population-based estimates for the prevalence of gender nonbinary people, approximately 35% of the 27,715 respondents of the 2015 U.S. Transgender Survey (USTS) identified as gender nonbinary.[60]

Some transgender individuals may seek medical (hormonal and/or surgical) interventions in addition to social or legal changes, e.g., changing their name and/or gender marker.[6]

Transgender women who receive gender affirming hormone therapy (GAHT) often use the same types of estrogens as postmenopausal women in addition to an androgen blocker, such as spironolactone, whereas transgender men use testosterone preparations that are dosed

similarly to preparations used for the treatment of cisgender men with hypogonadism.[41] Research on the psychosocial effects of gender affirming hormone therapy (GAHT) shows that transgender people experience improvements in psychosocial functioning and quality of life and experience lower rates of anxiety and depression.[42-44] Research on the medical outcomes of GAHT have focused mainly on investigating metabolic effects and adverse outcomes, such as dyslipidemias, venous thromboembolism, bone health, cardiovascular and cancer risk.[6, 41, 45-48].

Despite an increase in the number of publications focusing on transgender persons over the last decade, most of these have focused on mental health, e.g., anxiety, depression and other mood disorders, HIV and STIs (predominately among those assigned male at birth), substance use, violence, stigma and discrimination.[61] Studies have frequently been small cross-sectional studies, e.g., in gender clinics or STI clinics, or community-based studies using convenience sampling methods. Due to the lack of gender identity (separate from birth assigned sex) being a demographic variable measured in national surveys, there are no large-scale population-based studies and consequently few data on general health issues that affect the transgender population at large, such as rates of obesity, tobacco use, cardiovascular disease and cancer.[8, 33, 61] In addition, there are few data on the community's utilization of preventive health services, such as screenings for cancer and diabetes, although data exist that transgender persons are less likely to undergo preventive health screenings or to be aware of their HIV status, despite being among the highest risk groups.[19, 32, 33, 38-40] One study examined cancer screening among transgender people using data from the 2014-2016 Behavior Risk Factor Surveillance System surveys. This revealed that transgender women were less likely to undergo mammography compared to cisgender women and transgender men were less likely to have ever had a cervical pap test. The

authors also examined colorectal cancer screening. In the multivariable analysis gender nonbinary individuals had a lower rate of ever having a colonoscopy or sigmoidoscopy and transgender men had a statistically significant higher rate of being up to date with colorectal cancer screening than cisgender individuals.[40] There have been no studies examining the indirect effects of GAHT on primary care parameters, e.g., whether access to hormones is associated with uptake of preventive care, such as improvements in STI, HIV or cancer screenings or reductions in unhealthy behaviors such as tobacco or substance use.

The aim of this report therefore is to examine rates of utilization of gender affirming care as well as health indicators among transgender people. It was decided to examine colon cancer screening as the recommendations do not differ by assigned birth sex, unlike other screening recommendations, such as breast or cervical cancer, that may need to be modified in transgender people who have accessed hormones or surgery. The second health factor investigated was smoking status. The data were obtained using retrospective chart review data from a community health center in New York City. In order to make a comparison of health behaviors, the prevalence of screening practices and tobacco use will be compared to New York City benchmarks.

2.2 Methodology

Sample and Setting

A retrospective chart review of transgender and gender nonbinary patients was conducted between 1/1/2009 and 12/31/2010 using data from the electronic health records at Callen Lorde Community Health Center (CLCHC). This project was initiated to answer questions about the state of health of transgender patients age ≥ 18 years including uptake of preventive health services that would frame the direction of future prevention efforts. CLCHC is a health center in

New York City that provides primary care, transgender health, sexual health and HIV services to the lesbian, gay, bisexual and transgender communities and people living with HIV. CLCHC has been providing transgender primary care services for over a decade. The Center is located across 3 clinical sites and 2 administrative sites in lower Manhattan and the Bronx. Its main clinical site is a 27,000-square foot, six-story building that is an ADA-compliant, fully licensed New York State Department of Health Article 28 Diagnostic and Treatment Center. In 2002, CLCHC was also designated a Federally Qualified Health Center (FQHC) by the U.S. Department of Health and Human Services' Bureau of Primary Health Care. In 2018 CLCHC provided gender affirming services to 17,018 individuals, including 4,000 transgender and gender nonbinary individuals, making this the largest clinic cohort of transgender people in North America. In 2010, CLCHC had 14,961 unique patients and approximately 1700 of these identified as transgender and gender nonbinary.

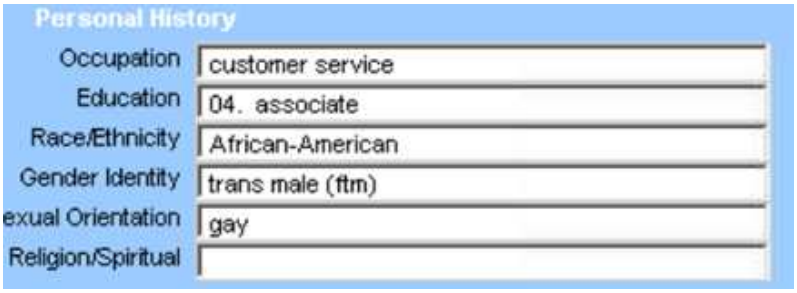
Although patient-related data cannot substitute for population level data, the CLCHC, as a Federally Qualified Health Center provides treatment care and support regardless of ability to pay, thereby attracting a clinic population that is racially, ethnically and economically diverse.

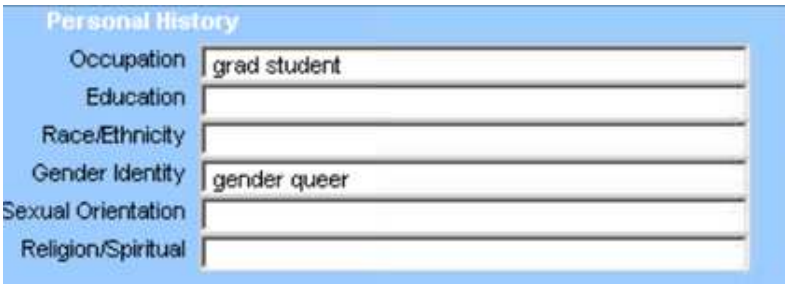
Data Extraction

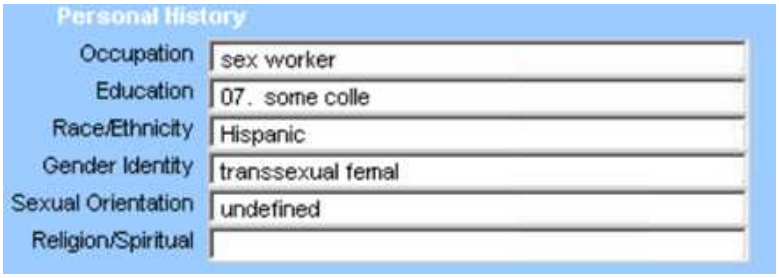
At the time of the study the CLCHC recorded data regarding birth sex and gender identity in several different locations, including paper registration forms and in the electronic health record. Established patients had the sex listed on their insurance card (frequently birth sex) at registration and in the electronic health record. There was a specific question in a social history template within the electronic health record that asked current gender identity, Figure 1. This included a dropdown list (male, female, trans male/FTM, trans female/MTF) and also allowed medical providers to write in a gender not listed. Figure 1. The Center's electronic health record

also included a preferred name field that permitted people to provide another name in addition to their legal name. Patients seeking gender affirming care were given ICD-9 codes for 259.9 (unspecified endocrine disorder).

Figure 1: Examples of gender identity listed in the social history template







Patient-level data obtained from the electronic medical records at CLCHC were used to investigate the demographic profile of transgender persons seeking care, to evaluate utilization of

health services, including preventive health services and to determine if these differed by age, race, ethnicity, use of GAHT and other demographic factors.

Subjects were registered patients 18 years of age or older treated at the CLCHC between 1/12009 and 12/31/2010.

Inclusion Criteria:

1. A patient treated at the health center between 1/1/2009 and 12/31/2010
2. Identified as transgender
3. Age 18 or older
4. No subject to be excluded from the study on the basis of gender, racial or ethnic origin.

Patient charts meeting any of these criteria were pulled for chart review to determine eligibility of transgender status:

- A person with a diagnosis code of 259.9 (unspecified endocrine disorder). At CLCHC transgender clients were usually assigned an ICD-9 code of 259.9 instead of group 30 codes (e.g. 302.85 – "gender identity disorder in adolescents or adults" or 302.5 codes "transsexualism").
- A person with two first names recorded on the registration screen. Patient first names are found in 2 fields, one for "preferred" and another for "legal" name. Discordance in the names may signify someone who is in the process of transition who has not changed their name legally.
- A person self-identified as transgender, transsexual, genderqueer, queer, gender nonconforming or other gender non-conforming term in the electronic health record social history template that patients had disclosed to their medical provider.
- A person with gender male or female in the social history template that differs from the gender listed in the registration template. A transgender person often has identity documents that have discordant genders, for example, medical insurance of a transgender male may still be

marked “female” which is the legal gender placed on the registration form. Discordance in these 2 records may signify that someone is transgender.

- A person with gender documented as female on the registration template who receives testosterone therapy. Although testosterone is prescribed for some medical conditions in women, the majority of clients receiving testosterone with legal gender marker female, will be transgender men.
- A person with gender documented as male on the registration template who receives estrogen therapy.
- A person who receives spironolactone therapy. Spironolactone is a common androgen blocker used in feminizing hormone regimens.

Due to the inherent difficulty with identifying transgender patients, an initial data run was conducted to identify transgender subjects using several criteria as outlined above. All patients that met at least one of the above criteria were deemed eligible for an in-depth chart review to determine gender identity. The charts were examined to determine whether each patient was transgender, i.e. identified as a gender other than their sex assigned at birth. This included a review of the medical history, physical examination and medication templates as well as reading through free text in the chart notes. The goal was to find criteria that would be sensitive for transgender identity. Factors used to maximize sensitivity for identifying transgender individuals included ICD codes, discordance between birth sex and affirmed gender identity, discordance between name and recorded gender and prescriptions for gender affirming hormone therapy. Variables collected also included: age, race, birth sex, current gender identity, gender of sexual partners, housing status, insurance, height, weight, blood pressure, cholesterol levels, presence of

diabetes, silicone use, tobacco use, alcohol use, sexually transmitted infections (gonorrhea, chlamydia, syphilis, HIV), gender confirming surgeries and hormone therapy.

Data Quality Assurance

- The study's principal investigator (PI) trained one chart reviewer using a standard chart review protocol. Both the trainer and trainee independently reviewed the same charts over a three day period (~20). After each chart was reviewed by both, discrepancies were noted and the chart re-reviewed to adjudicate discrepancies.
- Both the PI and the chart reviewer reviewed charts to determine eligibility into the study.
- The majority of data were entered by the chart reviewer, with random spot checks by the PI.
- We statistically examined the data with frequency distributions of outcome variables/endpoints to identify outliers or questionable data points that may have represented data errors.

After the first data run, the charts were examined by the PI and the trained chart reviewer to determine if the clients were transgender and prevent misclassification in the database. Information was collected and stored in a password-protected electronic database. The chart numbers were de-identified to protect patient confidentiality. There was no key or linking list to allow matching of patient or patient identifiers to the database.

This retrospective chart review (termed the Transgender Data Project on the application) obtained IRB approval from The Clinical Directors Network's institutional review board on September 7, 2011.

Comparison with the New York City Community Health Survey

Every year the New York City Department of Health and Mental Hygiene conducts a community health survey (NYC CHS) of non-institutionalized adults who are 18 years of age and older to better understand health care factors as well as risk behaviors. Respondents must have a cellular or landline telephone. The NYC CHS conducted a survey in 2011[62] that corresponded to the dates that patient data were collected from the CLCHC. The NYC CHS used a stratified random sample in order to obtain citywide estimates. The sampling frame for this study was derived from a list of telephone numbers provided to the DOHMH by a commercial vendor. Only one adult from a given household completed the 25-minute survey. The NYC CHS utilized a computer-assisted telephone interviewing system that was available in multiple languages. The survey covered a broad range of topics including demographics, socio-economic status, health insurance status, smoking and alcohol use, height, weight, sexual behavior, sexual identity, HIV testing and determined prevalence of a wide variety of chronic medical conditions, such as diabetes, hyperlipidemia and hypertension as well as uptake of preventive services, including colonoscopy, mammography and cervical Papanicolaou tests. All of the information obtained was based on self-report and the data were cross-sectional. The 2011 NYC CHS contained questions on sex, education, race/ethnicity, employment, age, colonoscopy ever, HIV test ever and smoking. In 2011 a total of 8,792 individuals participated in the NYC CHS with a response rate of 40%. Additional details available at: https://www1.nyc.gov/site/doh/data/data-sets/community-health-survey.page

The survey data from the NYC CHS are freely available on the survey website and can be downloaded for public use. The survey was felt to provide a good comparison to the CLCHC transgender patient data because CLCHC patients form a subset of New York City residents, non-

institutionalized adults age 18 and over and the year of the survey (2011) matched the time frame that the chart review occurred. In addition, the NYC CHS captured many of the same variables that were collected during the chart review, such as age, race/ethnicity, insurance status, education, employment, tobacco use, colorectal cancer screening with colonoscopy and HIV screening.

Health indicators needed to be identified that would provide a meaningful comparison between the CLCHC transgender patients and the predominately cisgender NYC CHS survey participants. Many preventive health screenings are based on birth sex, e.g., cervical and breast cancer screening and osteoporosis screening, and therefore could not be compared, since transgender people may have undergone surgeries or taken hormones that directly impact on the need for screening. It was decided therefore to examine colorectal cancer screening rates in those over 50 years, as well as examine cigarette smoking rates since these do not change in people who have undergone surgeries or taken GAHT.

Once difference between the NYC CHS participants and the CLCHC patients was that the patients were engaged in care which might positively influence uptake of preventive screenings. What was unique about the 2011 NYC CHS is that it included a question about whether participants had "one person or more than one person you think of as your personal doctor or health care provider." NYC CHS participants who answered in the affirmative were therefore included in a merged data set to allow for better comparison between gender identity and health outcomes, since both survey participants and patients would be engaged in care.

The following questions and answers were mapped to similar questions in the data set of transgender patients. In addition, colonoscopy rates for eligible clients (age 50+) was compared between the two populations stratified by birth sex. The potential confounders, such as age,

education, insurance status, race and ethnicity were available in both datasets. Variables from the NYC CHS used in the analyses are listed in Table 1.

Table 1: Variables used from the New York City Community Health Survey

Recoded Variable	**Question**	**Source**	**Responses**	Recoding into new Variables
pcp11	Do you have one person or more than one person you think of as your personal doctor or health care provider?	Q2.3	1=Yes 2=No .d=Don't know .r=Refused	Only included pcp11=1
sex	Because it is sometimes difficult determine over the phone, I am asked to confirm with everyone. Are you male or female?	Q8.2	1=Male 2=Female	Birth Sex Gender identity 1= Male Cisgender male 2=Female Cisgender female
education	What is the highest grade or year of school you completed?	Q8.10	1=Less than HS 2=High school grad 3=Some college 4=College graduate .d=Don't know .r=Refused	Less than High School = 1 High or more = 2
Smoker	Have you smoked at least 100 cigarettes in your entire life? Do you now smoke cigarettes every day, some days, or not at all?	Q9.1; Q9.2	1= Never 2= Current 3= Former .d= Don't know .r= Refused	0=Never 1=Ex-smoker 2= Current smoker .d=missing .r=missing
evercolon 11	Colonoscopy is an exam in which a tube is inserted in the rectum to view the bowel for signs of cancer or other health problems. Have you ever had a colonoscopy?	Q11.1	1=Yes 2=No .d=Don't know .r=Refused . =Missing/Not asked	1=Yes 0=No .d=Missing .r=Missing . =Missing
everhivtest 11	Have you ever had an HIV test?	Q14.2	1=Yes 2=No .d=Don't know .r=Refused	1=Yes 0=No .d=Missing .r=Missing

newrace	Are you Hispanic or Latino? Some people, aside from being Hispanic, also consider themselves to be a member of a racial group. Which one or more of the following would you say is your race?	Q8.3, Q8.4	1=White Non-Hispanic 2=Black Non-Hispanic 3=Hispanic 4=Asian/PI Non-Hispanic 5=Other Non-Hispanic	1=Hispanic 3=White Non-Hispanic 4=Black Non-Hispanic 5=Asian/PI Non-Hispanic 6=Other Non-Hispanic
emp3	Employment status – three categories	Q8.12	1=Employed 2=Unemployed 3=Not in labor force .d=Don't know .r=Refused	1=Employed 2=Unemployed 3=Missing .d=Misisng .r=Missing
agegroup	What is your age? We are only asking this information to make sure we have talked to enough people in each age group. Can you just tell me if you are: (age groups)	Q8.1, Q8.1a	1=18-24yrs 2=25-44 yrs 3=45-64 yrs 4=65+ yrs .d=Don't know .r=Refused	1=18-24yrs 2=25-44 yrs 3=45-64 yrs 4=65+ yrs .d=Missing .r=Missing
age50up	See above	Q8.1, Q8.1a	1=50-64 yrs 2=65+ yrs . =Missing	1=50-64 yrs 2=65+ yrs . =Missing
education	What is the highest grade or year of school you completed?	Q8.10	1=Less than HS 2=High school grad 3=Some college 4=College graduate .d=Don't know .r=Refused	1=Less than HS 2=High school grad 3=Some college 4=College graduate .d=Don't know .r=Refused
nsuredgateway11	Do you have any kind of health insurance coverage, including private health insurance, prepaid plans such as H-M-Os, or government plans such as Medicare or Medicaid?	Q2.1	1=Yes 2=No .d=Don't know .r=Refused	

Analysis

Analyzing Transgender Data with Multiple Gender Categories

In order to analyze these data the gender identities were first collapsed into 4 main categories based on assigned sex at birth. Transgender individuals assigned male at birth who identified as transgender female/woman, MTF, transsexual and transgender individuals were placed in a binary gender identity called transgender women. This category also included transgender women who chose "female" as their sex assigned at birth. Nonbinary identities assigned male at birth (AMAB-NB) included gender nonconforming, genderqueer and those gender identities listed as "other" except for "woman of trans experience" which was included in the transgender women category. For individuals assigned male at birth with an apparent binary gender identity the category was called transgender men and included transgender male/man, FTM, transsexual and transgender individuals. Nonbinary identities assigned female at birth (AFAB-NB) included the identities listed as gender nonconforming, genderqueer and those listed as "other". We have also used the term "transmasculine" to include all people assigned male at birth (transgender men and AFAB-NB) and transfeminine to include all people assigned male at birth (transgender women and AMAB-NB), Table 2. There were 44 transgender individuals (29 transgender men and 15 transgender women) who chose their affirmed gender rather than sex assigned as birth on the original birth certificate when asked to answer this question. In the analyses they are included under the assigned sex on their original birth certificate.

Statistics

The prevalence of the health conditions and screenings were calculated overall and also separately by transfeminine/transmasculine identity and age category. Pearson chi-square tests or Fisher's exact tests for cell counts ≤5 were used to compare categorical variables by birth sex

and independent sample t-test to compare continuous variables by birth sex. To compare the rates of cigarette smoking and colon cancer screening with the NYC population, the transgender data were merged with a publicly available data set from the 2011 NYC CHS. Only survey participants who were engaged in care were included in the analyses. All respondents and transgender people were analyzed according to birth sex, with an additional variable added for transgender status (1= transgender, 0= not transgender). An assumption was made that over 99.5% of the NYC CHS were cisgender based on available population statistics. Multivariable logistic regression models were used to assess the associations among gender identity and tobacco and colon cancer screening. All p-values are two-tailed at a significance level of 5%. Analyses were performed using IBM SPSS Statistics for Windows, Version 26.0

Table 2: Description of gender identity categories used in the study

Transfeminine*		Transmasculine*	
Transgender woman	Non-Binary assigned male at birth	Transgender man	Non-Binary assigned female at birth
transgender female/woman, MTF, transsexual and transgender individuals, woman of trans experience	Genderqueer, gender nonconforming, other†	transgender male/man, FTM, transsexual and transgender individuals	Genderqueer, gender nonconforming, other

*Based on the assigned sex on the original birth certificate. † woman of trans experience was placed in the binary category.

2.3 Results

Using the criteria noted above, 3,197 records were initially retrieved. These were reviewed manually and 1,670 of the records were identified as transgender patients. In 2010, CLCHC had 14,961 unique patients, therefore the prevalence of transgender patients at the center was 11.2%.

Gender Identities in the Electronic Health Record

The 1,670 transgender people included 1,105 who documented their assigned sex at birth as male, 565 who documented their assigned sex at birth as female. Two intersex individuals were not included in subsequent analyses. There was considerable diversity in how clients identified their gender identity. Gender identities listed at least 4 times, including male, female and transgender male, transgender female, MTF (female-to-male), FTM (female-to-male), transsexual, GNC (gender nonconforming) and genderqueer are included in Table 3. An additional 42 (2.5%) patients identified as another gender such as multi-spirit, two-spirit, unicorn and androgynous, these identities were chosen 3 times or less and are summarized in Table 4.

Table 3: Documentation of gender identity in electronic health records

	Assigned Sex at Birth					
	Male		**Female**		**Total**	
Gender Identity	n	%	n	%	n	%
Male	2	0.2	88	15.3	90	5.4
Female	113	10.3	0	0	113	6.8
Genderqueer	2	0.2	24	4.2	26	1.6
FTM*	0	0	14	2.4	14	0.8
MTF*	13	1.2	0	0	13	0.8
Transgender	13	1.2	11	1.9	24	1.4
Transgender woman	885	81.0	0	0	885	53.0
Transgender man	0	0	413	71.6	413	24.7
Transsexual	39	3.6	7	1.2	46	2.8
GNC*	1	0.1	3	0.5	4	0.2
Other	25	2.3	17	2.9	42	2.5
Total	**1093**	**100**	**577**	**100**	**1670**	**100**

*MTF (male to female), FTM (female to male), GNC (gender nonconforming)

Table 4: Other Gender Identities

Three or fewer persons chose one of these terms to describe their gender identity: Ambiguous, andro, androgynous, boy, butch trans, dual-spirit, effeminate, female/drag, feminine aura, feminine male, femme butch queen, gender evolving, gender neutral, genderqueer, lady, male-gender, male id-butch, none, nothing, no gender, no label, no term, not well described, prefer not to say, queer, questioning, tomboy girl, trans identified, trans not stated, trans/two spirit, transvestite, two-spirit, undecided, undefined, unicorn, unidentified, unknown, unspecified, unsure, variant, whatever, woman of trans experience

Demographics

The mean age of the sample was 35.57 years, SD 11.54, range 18.0-85.1). Transfeminine and transmasculine individuals differed significantly by age, race, education and employment. Transfeminine individuals were on average 37.4 years old (range: 18.0-85.1) while transmasculine individuals were approximately 5 years younger, $p<.001$. Transmasculine individuals were predominately white (55.0%) whereas transfeminine individuals were more likely to be people of color (71.3%), $p<.001$. The two populations differed in other ways, including rates of education. Transmasculine individuals were more highly educated with 95.1% having at least a high school diploma, 33.1% having a 4-year college degree and 18.7% holding a graduate degree, compared to 84.1%, 17.7% and 6.6% among transfeminine individuals respectively, $p<0.001$. Unemployment rates were much higher among transfeminine people – 28.7% among transmasculine and 46.4% among transfeminine people, $p<.001$. While both groups had similar rates of being uninsured (12.2% and 14.1%, $p=.323$) the types of insurance were different with transmasculine individuals twice as likely to have private insurance, $p<.001$. Transmasculine individuals were more likely to report stable housing vs. unstable/homeless 96.6% vs. 93.5%, $p=.012$ Table 5.

Table 5: Demographics, tobacco, substance use and colonoscopy rates among transgender patients

	Transmasculine (n=577)		Transfeminine (n=1093)		All (n=1670)		t-test (df)	p-value (2-sided)
Mean age in years (SD) Range	32.15 (9.31) (18.3-70.5)		37.38 (12.18) (18-85.1)		35.57 (11.54) (18.0-85.1)		-9.022 (1668)	<.001
Race/Ethnicity	%	n=496	%	n=942	%	n=1438	$\chi 2$ (df)	<.001
Hispanic	11.7	58	29.4	277	23.3	335	114.38 (4)	
White	55.0	273	28.7	270	37.8	543		
Black	13.9	69	21.3	201	18.8	270		
Asian/Pacific Islander	5.8	29	7.4	70	6.9	99		
Other	13.5	67	13.2	124	13.3	191		
Education (highest level)	%	n=493	%	n=843	%	n=1336	132.82 (4)	<.001
Less than High School	4.9	24	15.9%	134	11.8	158		
High School Diploma	11.8	58	25.3%	213	20.3	271		
Some College	31.6	156	34.5%	291	33.5	447		
Bachelors' Degree	33.1	163	17.7%	149	23.4	312		
Graduate degree	18.7	92	6.6%	56	11.1	148		
Unemployment	%	n=540	%	n=962	%	n=1502	44.93 (1)	<.001
	28.7	155	46.4%	446	40.0	601		
Housing (stable)	%	n=526	%	n=939	%	n=1465	6.25 (1)	.012
	96.6	508	93.5%	878	94.6	1386		

Sex work	%	n=577	%	n=1093	%	n=1670	29.94 (1)	<.001
	0.3	2	5.5%	60	3.7	62		
Insurance	%	n=599	%	n=944	%	n=1443	147.60 (2)	<.001
Uninsured	12.2	61	14.1	133	13.4	194		
Private	60.5	302	28.6	270	39.6	572		
Public	27.3	136	57.3	541	46.9	677		
Substance use disorder	%	n=577	%	n=1093	%	n=1670	6.74 (1)	.009
	3.1	18	6.0	66	5.0	84		
Tobacco use	%	n=537	%	n=979	%	n=1516	6.03 (2)	.049
Never smoker	53.8	289	55.0	538	54.6	827		
Current smoker	25.3	136	28.9	283	27.6	419		
Ex-smoker	20.9	112	16.1	158	17.8	270		
Colonoscopy (≥50 years)	%	n=38	%	n=177	%	n=215	1.78 (1)	.183
	15.8	6	26.0	46	24.2	52		

Uptake of Gender-affirming Care

The majority (82%) of transgender people had accessed hormones, either testosterone for transmasculine or estrogens for transfeminine individuals. Transfeminine individuals were more likely to have accessed hormones, 83.5% vs. 78.9%, p=.018. Transmasculine surgical interventions included mastectomy, phalloplasty, metoidioplasty, hysterectomy and oophorectomy. Transfeminine surgeries included breast augmentation, orchiectomy, vaginoplasty and facial feminization surgery. Although these surgeries could not be directly compared, a variable for "any surgery" was created. Transmasculine individuals were more likely to undergo at least one gender affirming surgery (41.6% vs. 26.2%, p<.001) however transfeminine individuals were more likely to have received either hormones or surgery i.e., "any gender affirming intervention" (86% vs. 82%, p=.030). Table 6.

Table 6: Gender affirming care and gender identity

Transmasculine	n=577		Transfeminine	n=1093			
Interventions	N	%	Interventions	N	%	$\chi 2$ (df)	p-value
Hormones (testosterone)	455	78.9%	Hormones (estrogens)	913	83.5%	5.57 (1)	.018
Mastectomy	227	39.3%	Breast augmentation	167	15.3%	-	-
Metoidioplasty	6	1.0%	Orchiectomy	115	10.5%	-	-
Phalloplasty	4	0.7%	Vaginoplasty	103	9.4%	-	-
Hysterectomy	53	9.2%	Facial feminization surgery	98	9%	-	-
Oophorectomy	45	7.8%				-	-
Any surgery	240	41.6%	Any surgery	286	26.2%	41.66 (1)	<.001
Any gender affirming intervention (hormones/surgery)	473	82%	Any gender affirming intervention (hormones/surgery)	940	86%	4.70 (1)	.030

Colonoscopy and Cigarette Smoking among Transgender People (Table 5)

The rate of colonoscopy was evaluated for the 215 people who were aged 50 and over and therefore eligible for this procedure. Approximately 15.8% of transfeminine individuals had ever undergone a colonoscopy compared with 26% of transmasculine individuals, p=.183.

The rates of never smokers were similar by gender identity with 53.8% of transmasculine individuals and 55% of transfeminine individuals stating they had never smoked, p=.67. The rate of current smokers was higher among transfeminine individuals, 28.9% vs. 25.3% although this was not statistically significant p=.136

Comparisons with the New York City Community Health Survey data

The 2011 NYC CHS had 8,792 respondents of whom 7779 stated that they had one or more primary care providers. These 7779 "engaged in care" respondents were merged into the transgender data base.

Transgender people were younger than the individuals in the NYC CHS. The proportion of transgender individuals ≥50 years was 12.9% vs. 59.1%, p<.001. Transgender individuals were more likely to be people of color (62.2% vs. 53.9%, p<.001), unemployed (40.0% vs. 12%, p<.001) and uninsured (13.45 vs. 7.4%, p<.001). Similar proportions of transgender and NYC CHS respondents had received a high school diploma (88.2% vs. 86.6%, p=.115), Table 7

Table 7a: A comparison between demographic variables and health factors in the NYC CHS and transgender people at CLCHC

	Transgender (n=1670)		NYC CHS (n=7779)		All (n=9449)		t-test (df)	p-value (2-sided)
Age Group	%	n=1670	%	n=7761	%	n=9431	$\chi 2$ (df)	<.001
18-24	18.0	301	4.4	345	6.8	646	1654.81 (4)	
25-29	22.0	367	4.8	376	7.9	743		
30-44	38.9	649	21.2	1648	24.4	2297		
45-64	19.8	331	40.2	3120	36.6	3451		
65+	1.3	22	29.3	2272	24.4	2294		
50+	12.9	215	59.1	4585	51.38	4800		<.001
Race/Ethnicity	%	n=1438	%	n=7779	%	n=	$\chi 2$ (df)	<.001
Hispanic	23.3	335	22.8	1771	22.8	2106	470.30 (4)	
White	37.8	543	46.1	3583	44.8	4126		
Black	18.8	270	21.7	1688	21.2	1958		
Asian/Pacific Islander	6.9	99	7.7	597	7.6	696		
Other	13.3	191	1.8	140	3.6	331		
People of color	62.2	895	53.9	4196	55.2	5091	33.81 (1)	<.001
Unemployment	%	n=1502	%	n=4620	%	n=6122	582.76 (1)	<.001
	40.0	601	12.0	553	18.9	1154		

Table 7b: A comparison between demographic variables and health factors in the NYC CHS and transgender people at CLCHC

	Transgender (n=1670)		NYC CHS (n=7779)		All (n=9449)		t-test (df)	p-value (2-sided)
Education (highest)	%	n=1336	%	n=7735	%	n=9071	119.51 (3)	<.001
Less than High School	11.8	158	13.4	1037	13.2	1195		
High School Diploma	20.3	271	21.1	1633	21.0	1904		
Some College	33.5	447	20.4	1577	22.3	2024		
Bachelors' Degree	34.4	460	45.1	3488	43.5	3498		
≥High school Diploma	88.2	1178	86.6	6698	86.8	7876	2.49 (1)	.115
Insurance	%	n=1443	%	n=7756	%	n=9199	89.78	<.001
Uninsured	13.4	194	6.3	490	7.4	684		
Tobacco use	%	n=1516		n=7731		n=9247	210.89 (2)	<.001
Never smoker	54.6	827	59.1	4566	58.3	5393		
Current smoker	27.6	419	27.5	2123	25.9	2393		
Ex-smoker	17.8	270	13.5	1042	15.8	1461		
Current smoker	27.6	419	13.5	1042	15.8	1461	191.04 (1)	<.001
HIV Test Ever	%	n=1613	%	n=7499	%	n=9112	2.86 (1)	.091
	55.7	898	58	7499	57.6	5245		
Colonoscopy (age ≥50)	%	n=215	%	n=	%	n=	286.00 (1)	<.001
	24.2	52	76.1	3489	73.8	3581		

Colonoscopy rates in the NYC CHS for adults 50 and over were high, 76.8% of cisgender men and 75.7% of cisgender women had ever had a colonoscopy compared to 15.8% among transfeminine and 26% of transmasculine people, p<.001. The rate of ever having a colonoscopy was twice as likely in the age group 65+ compared to 50-64 (OR=1.98, 95% CI=1.73, 2.26) and among those who were insured (OR=2.1, 95% CI=1.60, 2.74). Female birth sex was associated with small (15%) increase in the rate of screening (OR=1.15, 95% CI=1.01, 1.31). The strongest association with ever having had a colonoscopy was transgender status, with transgender individuals being 90% less likely to have ever had a screening compared with cisgender individuals (OR=0.1, 95% CI= 0.07, 0.14). There was no association between race and ethnicity (dichotomized as white/nonwhite). Age, birth sex, transgender status, employment and insurance were included in the multivariate model. Birth sex and race were no longer significantly associated with colonoscopy screening. Age over 65 (OR=2.46, 96% CI=1.87, 3.26) and having insurance (OR=1.67, 95% CI=1.17, 2.39) and being uninsured (OR=0.66, 95% CI=0.50, 0.87) remained significant associations with screening. Transgender identity again had the strongest association with colonoscopy, with transgender people 84% less likely to be screened, (OR=0.16, 95% CI=0.11, 0.23).

Table 8

Table 8. Demographics and colon cancer screening (colonoscopy) among transgender patients and respondents of the New York City Community Health Survey 2011 ≥age 50 (n=4800): bivariate and multivariate logistic regression models

	Bivariate		Multivariate	
Variable	OR (95% CI)	p-value	OR (95% CI)	p-value
Age				
50-64	1.00	<.001	1.00	<.001
65+	1.98 (1.73, 2.26)		**2.46 (1.87, 3.26)**	
Birth sex				
Male	1.00	.035	1.00	.502
Female	1.15 (1.01, 1.31)		0.93 (0.77, 1.14)	
Gender identity				
Cisgender	1.00	<.001	1.00	<.001
Transgender	0.1 (.07, 0.14)		**0.16 (0.11, 0.23)**	
Race/ethnicity				
White (non-Hispanic)	1.00	.020	1.00	
People of color	0.86 (0.75, 0.98)		0.86 (0.71, 1.05)	.128
Employment				
Employed	1.00		1.00	.003
Unemployed	0.43 (0.34, .54)	<.001	**0.66 (0.50, 0.87)**	
Education			-	
No high school diploma	1.00		-	
High school diploma	1.15 (0.96, 1.37)	.123	-	
Insurance				
Uninsured	1.00		1.00	.005
Insured	2.1 (1.60, 2.74)	<.001	**1.67 (1.17, 2.39)**	

Current smoking rates were significantly higher among transgender individuals (27.6% vs. 13.5%, p<.001), Table 8. Birth sex female (OR=0.74, 95% CI=0.66, 0.83) and having a high school diploma (OR=0.67, 95% CI=0.58, 0.79) were also associated with lower odds of smoking. Increased odds of smoking were associated with being unemployed (OR=2.17, 95% CI= 1.86, 2.53), being non-white ((OR=1.29, 95% CI 1.15, 1.41) and transgender status (OR=2.45, 95% CI=2.15, 2.79). Insurance status was not associated with being a current smoker, p=.634. Age, birth sex, gender identity, employment and education were entered to the multivariate analysis. Race and birth sex were no longer associated with being a current smoker. Older age and having a high school diploma were associated with decreased odds of being a current smoker. Being unemployed (OR=1.62, 95% CI=1.38, 1.97) and transgender status (OR=1.92, 95% CI (1.61, 2.28 were associated with increased odds of being a current smoker). Table 9

Table 9. Demographics and cigarette smoking among transgender patients and respondents of the New York City Community Health Survey 2011 (n=9449): bivariate and multivariate logistic regression models

	Bivariate		Multivariate	
Variable	OR (95% CI)	p-value	OR (95% CI)	p-value
Age				
18-24	1.00		1.00	
24-29	1.15 (0.87, 1.52)	.316	1.06 (.77, 1.47)	.712
30-44	1.13 (0.89, 1.42)	.321	1.13 (0.86, 1.48)	.391
45-64	1.01 (0.80, 1.26)	.953	1.14 (0.86, 1.50)	.370
65+	0.39 (0.30, 0.51)	<.001	**0.47 (0.30, 0.74)**	**.001**
Birth sex				
Male	1.00	<.001	1.00	.305
Female	0.74 (0.66, 0.83)		0.93 (0.80, 1.07)	
Gender identity				
Cisgender	1.00	<.001	1.00	**<.001**
Transgender	2.45 (2.15, 2.79)		**1.92 (1.61, 2.28)**	
Race/ethnicity				
White (non-Hispanic)	1.00	<.001	1.00	.765
People of color	1.29 (1.15, 1.41)		1.02 (0.88, 1.19)	
Employment				
Employed	1.00	<.001	1.00	**<.001**
Unemployed	2.17 (1.86, 2.53)		**1.62 (1.38, 1.97)**	
Education				
No high school diploma	1.00	<.001	1.00	**<.001**
High school diploma	0.67 (0.58, 0.79)		**0.52 (0.42, 0.65)**	
Insurance				
Uninsured	1.00	.634	-	
Insured	0.95 (0.77, 1.18)		**-**	

2.3 Discussion

Demographics and Healthcare Utilization

This study demonstrated the diversity of gender identities held by transgender people. There were over 50 different terms that people claimed to describe both binary and nonbinary gender identities. The current recommended method to identify transgender people has been the two-step method, publicized by The Williams Institute, which asks both gender identity as well as sex assigned at birth.[63] This has been demonstrated to identify a greater number of transgender individuals than the one-step question that only asks whether a person is male, female or transgender, since there are transgender people who do not identify as trans, and will only check the male or female boxes.[64] The two step question has been validated and found to be acceptable to both transgender and cisgender people.[65-67] When this study was initiated the two-step question at the health center's registration had not been implemented, resulting in the need to use an algorithm consisting of ICD codes, medication history and discordance between name and gender as well as chart reviews to identify transgender people. In this analysis we discovered that some transgender people will not accurately report their sex assigned at birth; there were 44 transgender individuals who chose their affirmed gender rather than sex assigned as birth for clinic registration--29 transmasculine (5.13%) and 15 transfeminine individuals (1.36%) misreported their birth gender. This raises concerns for their health care since many health screenings such as cervical, breast and prostate screening are based on birth sex. In large data sets being developed to follow cohorts of transgender people, this should be considered as a potential source of misclassification.

The very large number of terms used for gender identity can cause some challenges for data analysis. Previous papers have reported on the diversity of gender identities.[3, 60] This paper has proposed a way to categorize transgender individuals into binary and nonbinary gender identities. In this dataset there were few people who identified as nonbinary (<3%) resulting in sparse data for analysis, hence the rationale for conducting analyses using umbrella headings of transfeminine and transmasculine. Unfortunately, this obscured any health disparities between nonbinary and binary identified transgender people which have recently been documented.[68-70]

Baseline characteristics

The transfeminine and transmasculine individuals attending the Center differed in multiple ways. Transmasculine people were younger, predominately white, more highly educated, more likely to be employed and have stable housing compared with transfeminine individuals. Transgender women also had higher rates of current smoking. These findings are consistent with several other studies that indicate transgender women experience high levels of felt and enacted stigma often resulting in social marginalization, high rates of homelessness, sex work, incarceration, depressive symptoms and unhealthy behaviors, such as tobacco use, alcohol, substance use and illicit use of silicone[71-75]

Gender affirming care

Uptake of gender affirming hormone therapy was high in both groups, with 79% of transmasculine and 84% of transfeminine people using hormones. Fewer individuals had accessed gender affirming surgeries, possibly because the timing of this chart review preceded the overturning of the longstanding ban on the use of Medicare funds to pay for gender

affirming surgeries in 2014 [76] as well as a determination by the Department of Health and Human Services in its Final Rule that Section 1557 of the Affordable Care Act addressing sex discrimination also included discrimination on the basis of gender identity, stating that "explicit categorical exclusions in coverage for all health care services related to gender transition are facially discriminatory".[77, 78] Lastly, New York State Medicaid did not change its exclusion on transition related care until 2015.Over half of transfeminine individuals at the time of this study had public insurance and therefore would not have been able to easily access surgeries.

In this report 26.2% of transfeminine individuals had accessed any gender affirming surgery compared to 41.6% of transmasculine individuals. The most common surgery for transmasculine people was bilateral mastectomy (39.3%) whereas the most common procedure for transfeminine individuals was breast augmentation (15.3%). The first US Transgender Discrimination Survey was published in 2011, around the same time as this retrospective chart review, and included the experiences of 7500 transgender respondents across the USA. Similarly, about 80% of transgender women and 69% of transgender men had accessed hormone therapy. Approximately the same number of transgender men had accessed mastectomy (43%), but the rates of genital surgeries were much higher in the survey - metoidioplasty 4%and phalloplasty 2%. Twenty one percent of transgender women had undergone breast augmentation and 23% vaginoplasty, both higher than reported in this study.[39] This difference in surgery rates between The US Transgender Discrimination Survey and patients at the Center is possibility due to lower unemployment rates observed among study participants (14% vs. 40%) and therefore greater ability to pay for these surgeries out-of-pocket.

Colonoscopy rates

The 2016 US Preventive Services Task Force recommendation on screening for colorectal cancer states that screening for colorectal cancer should occur in adults aged 50 to 75 years.[79] There are different methods used for screening including colonoscopy, flexible sigmoidoscopy and stool based tests such as the fecal occult blood test and the fecal immunochemical test.[80] Colorectal cancer screening rates are increasing nationally and are currently over 60% for eligible adults 50 years and older.[81] The results from this survey, however, showed extremely low utilization of colonoscopy of <25%. Even after adjusting for age, race, education, birth sex, employment and insurance, transgender status remained strongly associated with failure to undergo screening. Transgender people frequently face stigma and discrimination in healthcare settings that may deter them from seeking preventive health care or delaying necessary healthcare services.[39, 82] including low rates of cervical pap tests in transgender men.[83] Only one other study has examined colonoscopy rates in this population using data from the Behavioral Risk Factor Surveillance System Surveys 2014-2016. In that investigation higher rates of colorectal cancer screening were seen among transgender men and lower lifetime rates of endoscopy (colonoscopy and sigmoidoscopy) for gender nonbinary people. Although there was a trend to lower endoscopy rates among transgender women, this was not significant.in the multivariable analysis.

Smoking Rates

In this study current tobacco use was approximately 25% among transmasculine and 29% among transfeminine people. Several studies have demonstrated elevated tobacco use among transgender people from 30-83%[74, 75] and a recent national study demonstrated high previous

30 day use of tobacco products among transgender people 40% vs 25% among cisgender people, as well as a higher smoking prevalence among transmasculine compared with transfeminine individuals, which differed from what was found in this report.[76] The analysis with the NYC CHS confirmed that an excess of current smoking exists in transgender populations, even after adjusting for age, race, birth sex, employment and education, which are all factors known to be associated with tobacco prevalence.

Limitations

The main limitation for this study is that the transgender patients were from a single clinic in New York City and therefore may not be representative of transgender patients across the US. Clinic procedures may have been associated with the low colorectal screening rates, e.g., if providers did not offer screening. Additionally, data within the medical records, especially those that rely on self-report (e.g., cigarette smoking) may be inaccurate. Patients may have under-reported their smoking behavior thereby introducing bias, known as social desirability bias. The result of this bias however would have been attenuation of the odds associated with smoking. Other inaccuracies may be due to medical providers not entering information about risk such as cigarette smoking in the medical record, however this also would have attenuated the odds.

The data used in this analysis came from a chart review conducted over 9 years ago and it is possible that trends in health care uptake may have changed due to greater accessibility of insurance and health settings willing to provider gender affirming care. The study is still relevant however due to the fact that there have been few studies published during this time examining rates of colorectal cancer screening and few that have investigated other primary care outcomes.

Although attempts were made to adjust for potential confounders, it is possible that residual confounding or unknown confounders existed. Finally, the use of the NYC CHS data set for comparison assumed that a very low proportion of the respondents in the survey were transgender. Based on current estimates, about 0.4 to 0.6% of the population is transgender. This equates to 31-47 transgender people who may have been misclassified as cisgender in the data analysis and would have been unlikely to change the results.

2.4 Conclusion

This study has described the baseline characteristics of transgender people engaged in medical care, including the utilization of gender affirming care, uptake of preventive services (colonoscopy) and prevalence of cigarette smoking. Identification of transgender people within datasets is challenging but needs to be prioritized in order to better identify potential health care disparities. For example, this study revealed extremely high rates of cigarette smoking, double that of other New Yorkers. In addition, the uptake of colonoscopy for colorectal cancer screening was about one third of the rate expected.

This paper provides an algorithm for identifying transgender people in large data sets in situations where the 2-step method has not been implemented. It also offers a caution that misclassification of birth sex may occur, an issue not previously reported, that can result in difficulty assessing patients for appropriate screening interventions.

Chapter 3: Health Outcomes of Transgender Women who have Undergone Vaginoplasty Surgery: A Scoping Review

3.1 Background

Transgender individuals (i.e., those whose gender identities differ from the sex which they were assigned at birth [6]) are estimated to account for 0.39% of the United States adult population or approximately 1 million people. [1] Further estimates place the number of transgender adults at 25 million worldwide.[58] Some transgender individuals experience gender dysphoria, or distress related to the incongruence between their gender identity and their sex assigned at birth[84] and may seek out hormonal or surgical interventions in addition to social or legal changes, e.g., changing their name and/or gender marker.[6] Hormones and surgeries help to align a transgender individual's physical appearance with their affirmed gender identity. Surgeries undertaken by transmasculine individuals (those assigned female at birth) include chest reconstruction (usually bilateral mastectomy) and genital surgeries, including metoidioplasty, phalloplasty, scrotoplasty, hysterectomy, oophorectomy and vaginectomy.[6, 85] Surgeries undertaken by transfeminine individuals (those assigned male at birth) include breast augmentation, facial contouring, chondrolaryngoplasty (reduction of the "Adam's apple"), and genital surgeries, including orchiectomy, penectomy and vaginoplasty (creation of a vagina).[6, 85] The first vaginoplasty surgeries involved removal of the genitals (penectomy and orchiectomy) followed by a second stage procedure to create the vagina using split skin grafts (SS).[86] This technique using skin was based on surgeries done on cisgender (i.e., not transgender) women with congenital absence of the vagina and was first described in the 1890s by Robert Abbe.[87] Modern day vaginoplasty procedures in transgender women generally fall

into 2 types, penile inversion (PI) that uses penile and sometimes scrotal skin, and intestinal or colo-vaginoplasty (CO) that uses bowel for the neovaginal lining.[85, 86, 88, 89]

A large national survey (2015 US Trans Survey) of approximately 28,000 transgender and gender non-binary participants indicated that although only 5% of transgender men had undergone phalloplasty or metoidioplasty, 44% planned to have it one day. Among transgender women participants, 12% had undergone vaginoplasty or labiaplasty, however 54% reported that they wanted it some-day.[60]

For many years, access to these gender-affirming interventions, especially surgeries, were limited. This was predominantly due to insurance companies excluding coverage, calling such interventions "cosmetic" or "experimental" or denying payment on the basis of pre-existing conditions.[90] In the 2015 US Trans Survey, 25% of individuals had been denied insurance coverage for hormones and 55% for surgical interventions within the previous year,[60] but the US landscape for insurance coverage of transgender-related care is starting to change. In 2014 the longstanding ban on the use of Medicare funds to pay for gender affirming surgeries was lifted.[76] Subsequently, the Department of Health and Human Services (HHS) in its Final Rule determined that Section 1557 of the Affordable Care Act addressing sex discrimination also included discrimination on the basis of gender identity, stating that "explicit categorical exclusions in coverage for all health care services related to gender transition are facially discriminatory".[77] Changes in the private sector have also occurred with an increasing number of employers beginning to include insurance coverage for gender-affirming care as a benefit within commercial plans.[78]

Evaluation of insurance claims data has verified a year-by-year increase in the number of people accessing gender-affirming surgeries.[91] A study examining 37,827 hospital inpatient visits from people having an ICD code of gender identity disorder (GID) or transsexualism demonstrated that 3,586 (approximately 10%) involved gender-affirming genital surgery. Of all gender affirming surgeries conducted in the time periods 2000-2005 and 2006-2011 the proportion of genital surgeries increased from 72% to 83.9%, (P = .003).[92]

The increase in the number of transgender individuals undergoing gender affirming surgeries has important consequences for primary care providers in the US. Several surveys have indicated that curricula in nursing, medicine and dental schools do not include adequate content in transgender health care[93-96] and that clinicians are not sufficiently prepared to provide culturally competent trans-affirming care. [97-100] A survey of 178 medical schools on lesbian, gay, bisexual and transgender related curricula revealed that content related to sex reassignment surgery was one of the least likely to be included.[94]

The current guidelines usually followed by healthcare providers who care for transgender patients include The World Professional Association for Transgender Health's *Standards of Care (SOC) for the Health of Transsexual, Transgender, and Gender Nonconforming People[6]* and the Endocrine Society's *Endocrine Treatment of Gender-Dysphoric/Gender-Incongruent Persons: An Endocrine Society Clinical Practice Guideline* [41] neither of which provides comprehensive information about immediate or long term postoperative care issues. Aggregating existing research and identifying gaps in knowledge will be useful for clinicians providing primary care and surgeons, inform future research, as well as assist policy makers seeking to create quality measures for care of transgender people.

Several narrative and systematic reviews [47, 48, 50-53] have examined long-term health outcomes related to cross-sex hormone therapy; however, to our knowledge, although there have been systematic reviews of surgical techniques, short term health outcomes and a recent review of outcome measures,[54-57] there have been no comprehensive reviews investigating short and long-term health outcomes related to these surgeries for transgender women who have undergone genital surgery.

This paper will focus on health outcomes after gender affirming genital surgery in transgender women rather than both transgender women and men because there is more standardization of feminizing surgeries, allowing for better comparison of outcomes over time and across countries. With masculinizing surgeries there is considerable variation in the procedures performed, e.g., metoidioplasty with or without urethral lengthening, phalloplasty using different graft donor sites, optional procedures such as testicular implants, penile protheses, hysterectomy and vaginectomy, making such comparisons difficult.

Hence, the aim of this review was to summarize the peer reviewed literature regarding genital surgery (vaginoplasty) in transgender women, including a description of different surgical techniques, quality measures, postoperative complications and long-term health outcomes. As a literature review of the topic has not previously been conducted, a scoping review was undertaken since that is a preferred method to undertake for formative research in an area that has not been reviewed comprehensively.[101]

3.2 Methods

We followed the 5-step framework for a scoping review outlined by Arksey and O'Malley[102, 103] including (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) charting the data and (5) collating, summarizing and reporting the results[101]

Stage 1: Identifying the research question

What is the scope of the literature related to vaginoplasty surgery health outcomes? What are the gaps that can be addressed in future research?

Stage 2: Identifying relevant studies

The first vaginoplasty surgeries in transgender women were reported as early as the 1920's,[86] however the modern technique of penile-inversion vaginoplasty was developed in the mid 1950's by Dr Georges Burou.[104] We decided therefore to conduct a search of relevant studies published between 1956 and 2017.

The initial search strategy used a combination of key words and relevant medical subject headings (MeSH), and included the following databases: PubMed, EMBASE and Cumulative Index to Nursing and Allied Health Literature and Web of Science. We also hand searched issues of the International Journal of Transgenderism (IJT), the first peer-reviewed academic journal covering research on gender dysphoria from the first volume July - September 1997 through December 2018. The terminology related to transgender persons has changed over the time frame included in the search, for example transgender women today would have been referred to as transsexual men or transvestites in the early studies, requiring the use of multiple search terms (Table 1).

Table 1. Search terms used for the database search

Transgender	Vaginoplasty
"Transsexualism"[Mesh] "Transgender"[Mesh] Transsex*[tiab] Transsexual Transvestite Transgender*[tiab] Gender identity disorder*[tiab] Transsex*[ot] Male-to-female*[ot]	Vaginoplast*[tiab] Neovagina*[tiab] "Sex Reassignment"[Mesh] Sex reassignment*[tiab] Sex change*[tiab] Gender reassignment*[tiab] Gender change*[tiab] Sex reassignment*[ot] sex change*[ot]

Stage 3: Study Selection

All study designs were included if they addressed the research question: What is the scope of the published research(?) related to vaginoplasty surgery health outcomes? Due to the relative paucity of literature in this field we did not reject studies based on sample size and also included case reports that addressed complications.

Specific inclusion criteria were:

1. Study design: Case reports, case series, retrospective and prospective studies
2. Year: Published between 1/1/1956 and 12/31/2018
3. Outcomes: Study included information on complications or outcomes after vaginoplasty or included at least 1 quality measure
4. Surgery: Primary vaginoplasty surgery

5. Gender: Transgender or nonbinary identity assigned male at birth

6. Age: Adult (16+)

7. Full article available in English

Specific exclusion criteria included published reviews of surgical techniques without outcomes data, opinion pieces, revisions or secondary surgeries, surgery conducted on children or intersex individuals, and vaginoplasty surgery on cis-gender women (i.e., non-transgender women) for congenital vaginal atresia or other disorders of sex development and studies that included vaginoplasty surgeries in both transgender women and cis-gender women but that did not disaggregate outcomes for these 2 groups. English language abstracts were reviewed to determine the breadth of worldwide literature, although articles not available in English were excluded from the final mapping.

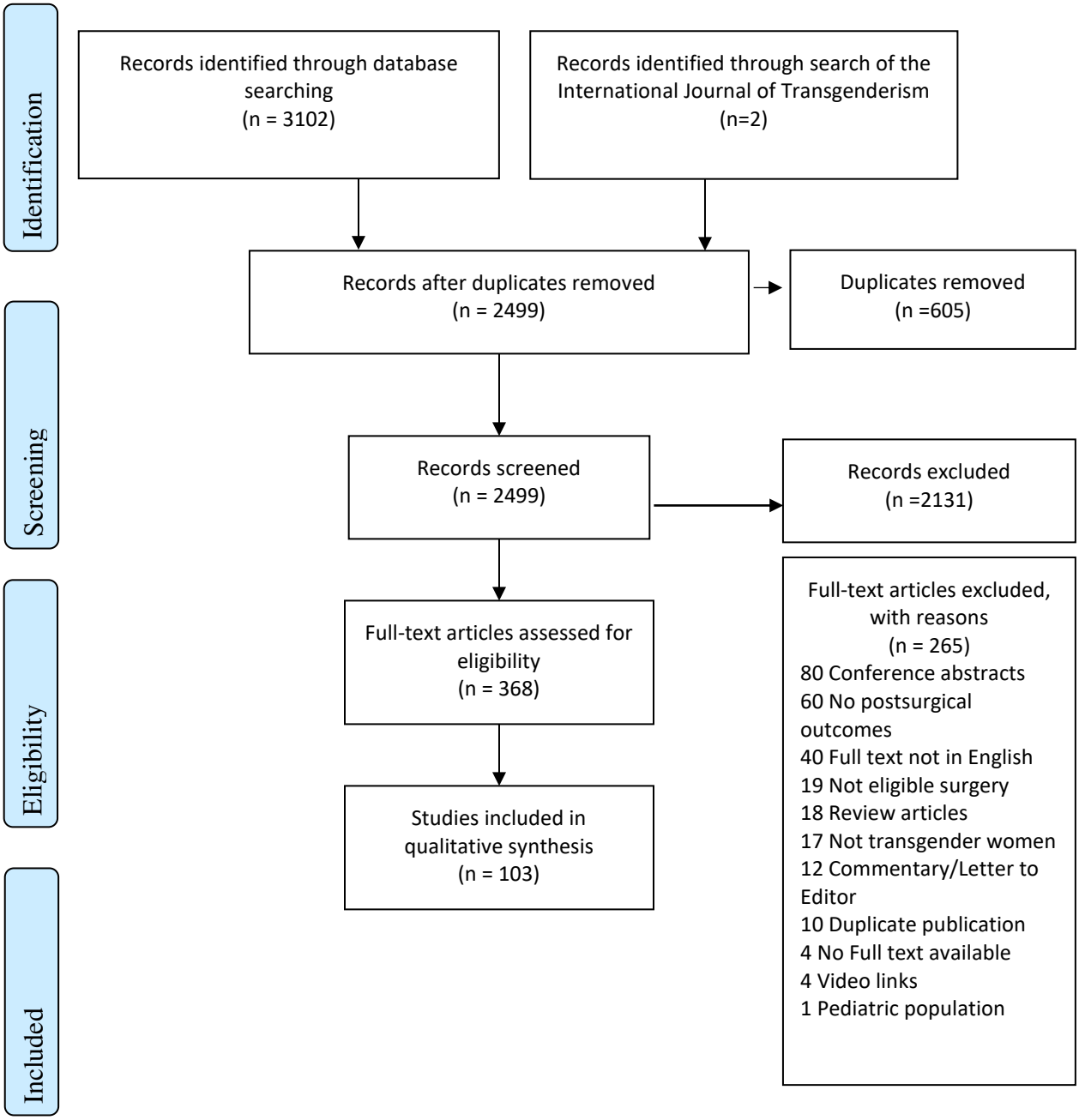
Study titles and abstracts were exported to Covidence (https://www.covidence.org/home), an online systematic review citation software that allows 2 or more people to independently conduct screening of abstracts, full-text review and study selection. Two reviewers (AR and PC) identified studies through review of study titles and abstracts to identify articles appropriate for full text review. Available options in Covidence were Yes, No and Maybe. Discordant answers resulted in a full review of the article. A third reviewer (AH) was available for consultation if consensus could not be reached. The data were extracted and entered into an Excel data base that included the following parameters: Publication year, Country, Study design, Sample size, Patient demographics (age), Type of surgery (penile inversion “PI”, colo-vaginoplasty “CO” or split skin graft “SS”), Duration of follow up, Surgical outcomes, Complications, Quality measures, Key findings. Articles that included more than one study design, e.g., an article that included a

retrospective chart review of all surgical cases as well as prospective follow-up of a subset of patients contributed data to two different study designs.

3.3 Results

Using these database search strategies, 3,102 citations were identified, of which 605 were duplicates. The hand search of the International Journal of Transgenderism yielded 2 additional articles that met initial screening criteria. Screening of the remaining 2499 papers (review of titles and abstracts) determined that 2,131 were irrelevant or did not meet the inclusion criteria. Full text review was completed for 368 papers, after which 265 were eliminated: 80 were published conference abstracts, 60 did not provide post-vaginoplasty outcomes, 40 did not have full text available in English, 19 included ineligible surgeries (e.g., secondary procedures and revisions), 18 were review articles, 12 were letters to the editor or commentaries, 17 did not provide data on transgender women (vaginoplasty surgeries in cisgender women or intersex people with vaginal agenesis or data were not disaggregated between cis-gender and transgender women), 10 were studies that had been previously published in another journal and data were already included, 4 had no full text available, 4 were videos only and 1 was excluded as it focused on pediatric populations. The final sample comprised 103 studies for inclusion in this scoping review. (Figure 1)

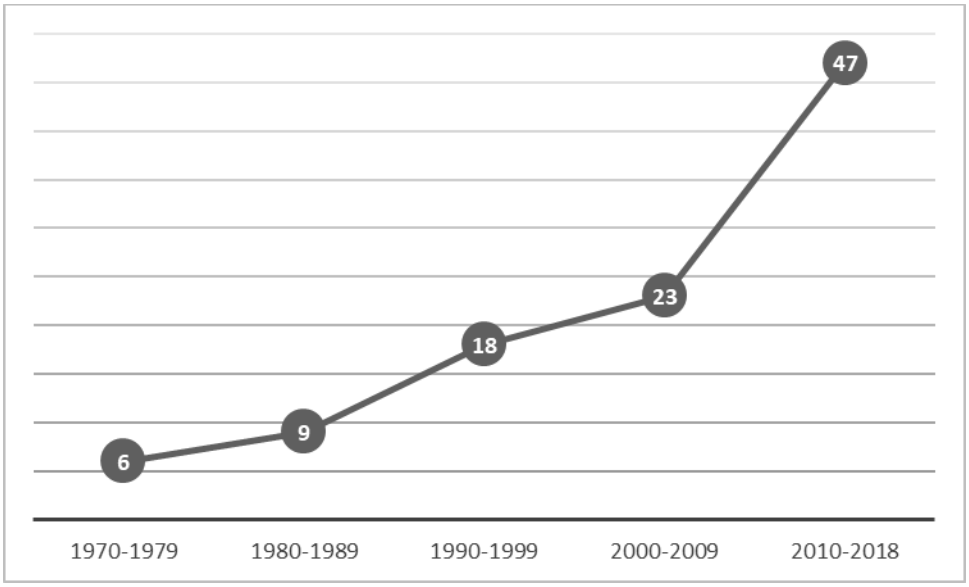
Figure 1: **Flowchart of articles selected for inclusion in scoping review.**



Timeline

There has been a steady increase in the number of published articles on vaginoplasty surgery that met the eligibility criteria. In the years 1970-1979 6 articles were published compared to 47 in the years 2010 to 2018 (Figure 2).

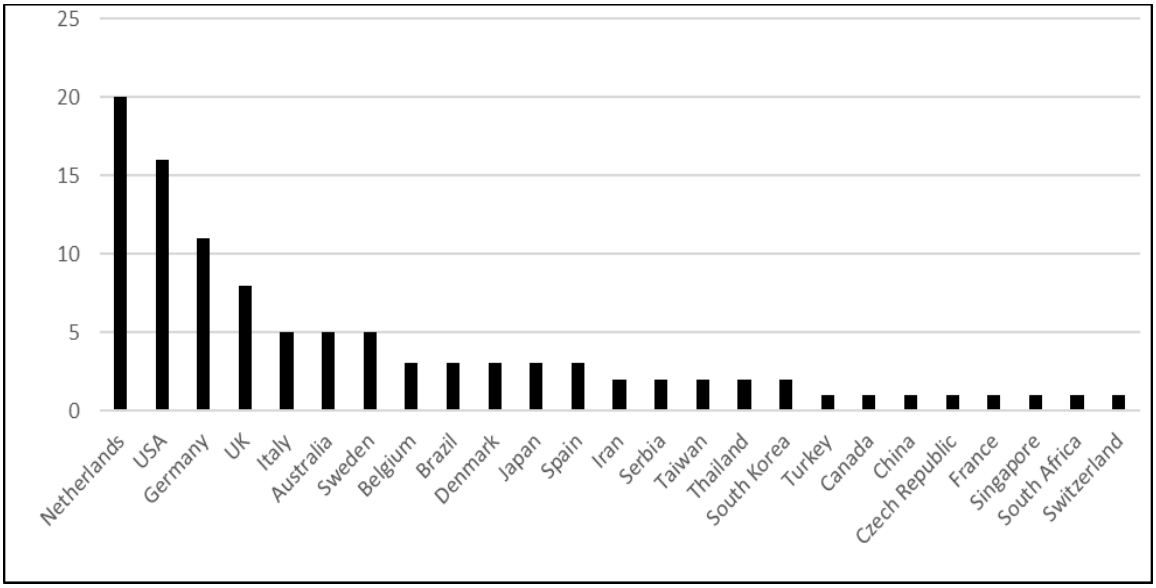
Figure 2: Publications by Year 1970-2018



Geographical Representation

The majority of articles were published in the United States and Europe. European gender centers published the majority of articles (62%) followed by United States and Canada (17%) and Asia (16%). One article was identified from an African country (Figure 3).

Figure 3: Publications by Country



Study Designs

The majority of publications (53) were retrospective chart reviews that originated from both high and low volume surgical centers worldwide reporting on predominately short-term perioperative outcomes for penile inversion and intestinal (colon) vaginoplasty surgery for 3,853 women. The number of surgical cases included in each article ranged from 2 to 500. Postoperative complications from these retrospective reviews are listed in Table 2. Twenty of these studies used mixed methods and, in addition to chart reviews to assess perioperative complications, also included a prospective component (e.g., using surveys or in person interviews) to assess health outcomes at a later date. [105-124] Thirty-six publications were case reports or case series predominately describing uncommon surgical complications and long-term outcomes. Thirty-four publications included prospective data and compared pre- and post-operative outcomes or compared outcomes between transgender women and cisgender women, transgender men or normative population data.

Outcome Measures for Vaginoplasty

Over the years there have been multiple outcomes investigated as measures of successful surgery. These have included vaginal depth and width, aesthetics, sensation, ability to have sexual intercourse (function), ability to orgasm, romantic/sexual partnerships, arrests/criminality, feeling more "feminine," and quality of life (Table 2).

Table 2: Vaginoplasty Outcome Measures

Outcome Measures	**Studies**
Sexual adjustment: Sexual intercourse frequency, pleasure, sensation, sexual partners, ability to orgasm	[89, 105, 106, 108, 111-113, 116, 117, 119, 120, 122, 124-135]
Aesthetics: patient and/or surgeon graded	[107, 108, 111-113, 117, 120, 122, 124, 126, 128, 129, 133-140]
Satisfied with surgery	[89, 108, 110, 116, 117, 120, 122, 124-127, 129, 134, 137, 141-145]
Interpersonal relationships/family/friends	[71, 105, 109, 111, 112, 116, 125-127, 129, 133, 134, 138-140, 143, 146-148]
Quality of life measures	[71, 105, 109, 116, 119, 127, 129, 131, 134, 135, 143-147]
Vaginal depth/width	[89, 106, 111, 113, 117, 120, 125, 129, 147]
Subjective well being	[119, 132, 135, 144, 146, 149]
Married/relationship yes/no	[71, 130, 146, 150]
Social adjustment	[13, 105, 132, 138, 147]
Economic adjustment/Employment	[134, 143, 146, 147]
Feels more feminine after surgery	[127, 140, 150]
Education level	[127, 140, 147, 150]
Criminality/arrests	[147, 151]

Perioperative Complications

Perioperative complications were mostly documented by retrospective reviews of surgeries performed at high volume gender clinics. We found no published articles that discussed the expected timeline for complications experienced by transgender women having gender affirming surgery. The majority of the studies included in this paper provided information beyond hospitalization and immediate perioperative complications, providing a range of 6 months to 13 years follow up after surgery. The most frequently reported postoperative complications were vaginal stenosis, urethral strictures, rectovaginal fistula, bleeding, and infection. Two studies provided additional details regarding timing of the complications, e.g., whether perioperative, at the first follow-up appointment or later [115] or ≤1 year vs. > 1 year.[122]

Table 3 provides the full list of vaginoplasty complications reported and number of studies in which these were mentioned.

Table 3: Perioperative Vaginoplasty Complications Reported

Complication	Number of Papers	References
Urethral stricture/other urethral complications	30	[106-112, 115, 117, 120, 122, 128, 133, 137, 139, 150, 152-161]
Vaginal stenosis	30	[89, 106, 108, 110, 111, 115, 117-120, 122, 124, 125, 128, 130, 136, 137, 139, 150, 152-162]
Rectovaginal fistula	21	[105, 108, 111, 117, 122, 124, 128, 130, 137-139, 146, 150, 152, 155, 157-159, 162, 163]
Bleeding	17	[108, 115-118, 124, 128, 148, 152, 158-165]
Infection	15	[89, 105, 112, 115, 118, 122, 124, 128, 139, 146, 150, 152, 158, 161, 165]
Rectal lesion/injury	11	[112, 115, 117, 118, 128, 139, 146, 159-161, 163]
Short vagina/shrinkage	10	[105, 108, 111, 118, 128, 138, 139, 146, 162, 166]
Urination problems	10	[105, 107, 115, 118, 124, 128, 133, 160-162]
Pain	9	[105, 108, 118, 120, 124, 128, 156, 157, 162]
Vaginal prolapse	8	[112, 115, 122, 124, 128, 150, 154, 158]
Full/partial flap failure	7	[106, 109, 115, 117, 128, 156, 161]
Urethral/Vesicovaginal fistula	7	[112, 122, 128, 139, 150, 158, 162]
Retention of bulbous spongiosum	6	[106, 109, 110, 115, 122, 155]
Hematoma	5	[106, 124, 128, 139, 158, 166]
Wound dehiscence	4	[128, 159, 162, 164]
Delayed healing	4	[118, 148, 151, 160]
Clitoris too large	3	[109, 118, 148]
Necrosis glans penis	3	[109, 112, 139]
Excessive vaginal secretion	2	[124, 157, 167]
Venous thromboembolism	3	[89, 115, 150]
Excess labial tissue	2	[128, 148]
Hair in vagina	2	[108, 115]
Vaginal skin defect	2	[111, 158]
Miscellaneous vaginal complaint	2	[106, 162]
Compartment syndrome	2	[128, 146]
Dilation problems	2	[105, 162]
Granulation tissue, Phantom penis, Pneumothorax, Colitis, Stroke, Bowel obstruction, Diarrhea, Bladder tear, Torn gastrocnemius muscle	1	[89, 105, 117, 120, 122, 124, 146, 165]

Vaginoplasty Outcomes from Case Reports

Many of the publications (n=36) were case reports or case series reporting unusual or novel occurrences. These case reports/case series included outcomes on 51 women, 24 of whom had penile-inversion and 18 who had colo-vaginoplasty surgery and 1 split skin graft. For 9 women the type of tissue used for the surgery was not provided. Age at presentation (where provided) ranged from 19 to 57 (average age 38 years). The time between surgery and the complication or unusual occurrences ranged from 1 day to 45 years, average 8.4 years. Case reports (Table 4) included neovaginal infections such as *Neisseria gonorrheae*, condyloma acuminata, Herpes simplex and bacterial vaginosis. These infections would fall under the category of "unusual or novel occurrences" since there are few data on neovaginal infections. Medical complications in women who had neovaginas constructed from bowel tissue included diverticulitis, diverticulosis, diverticular phlegmon, ulcerative colitis and diversion colitis. Other complications reported in the case reports included vaginal dysplasia and cancer.

Table 4: Summary of Case Reports

Author/Year	Sample size	Age*	Time between surgery and Complication*	Vaginoplasty Type†*	Adverse outcomes
Hennigan 1992[168]	1	42	16 years	CO	Ulcerative colitis
Freundt 1994[169]	1	41	3 years	CO	Vaginal prolapse
Bodsworth 1994 [170]	1	37	14 years	PI	Neisseria gonorrheae
Hage 1995 [157]	1	42	6 years	CO	Diversion colitis
Hage 1996 [171]	7	NR	19 years	NR	Labial mass from retained epididymis
		NR	9 years	NR	Dyspareunia caused by cavernous tissue remnant
		NR	10 years	NR	Chronic labial swelling due to fistula
		NR	12 years	NR	Chronic labial swelling due to fistula
		NR	1 year	NR	Prostatic fistula
		NR	12 year	SS	Labial abscess
		NR	NR	CO	Labial abscess
Van Engeland 2000[172]	3	37	7 years	PI	Condyloma acuminata
		36	NR	CO	Diversion colitis
		45	10 years	CO	Diversion colitis
Lawrence 2001[173]	1	36	5 years	PI	Vaginal intraepithelial neoplasia
Liguori 2001[174]	1	39	4 months	CO	Perforation of neovagina/peritonitis
Harder 2002[175]	1	42	18 years	PI	Squamous cell carcinoma

Abraham 2004 [176]	1	57	25 years	CO	Acute diverticular phlegmon
Liguori 2004 [177]	1	27	6 months	PI	Condyloma acuminata
Condous 2006 [178]	1	40	16 years	PI	Vaginal prolapse
Jain 2007 [179]	1	26	2 years	PI	Bacterial vaginosis
Namba 2008 [180]	1	52	6 months	PI	Phantom erectile penis
Sukumaran 2009 [181]	1	48	18 years	CO	Neovaginal calculi
Yang 2009 [182]	1	23	20 months	CO	Condyloma gigantea
Lin 2010 [183]	2	32	10 years	PI	Urethral stricture
		46	27 years	PI	Urethral stricture
Amirian 2011 [184]	1	52	34 years	CO	Neovaginal perforation
Aminsharifi 2012 [185]	1	24	8 months	CO	Entrapment of metallic dilator
Altomare 2013[186]	1	31	2 weeks	PI	Recto-neovaginal fistula
Deliktas 2018 [187]	1	33	7 years	PI	Neovaginal perforation
Rezwan 2014 [188]	1	54	13 months	NR	Bilateral ureteric obstruction
Fernandes 2014 [189]	1	53	21 years	PI	Squamous cell carcinoma
vanderSluis 2015 [190]	1	33	3 years	CO	Neisseria gonorrheae
Shimamura 2015[191]	1	33	4 years	CO	Perforation of neovagina/peritonitis
Aghayev 2015 [192]	1	39	8 years	CO	Neovaginal variceal bleeding
Bakker 2015 [193]	1	56	31 years	CO	Diverticulosis
Matsuki 2015 [194]	1	23	2 years	PI	Condymoma acuminatum

Hyun Jong Kim 2015 [195]	1	29	6 years	PI	Pelvic inflammatory disease
Suchak 2015 [196]	4	NR	6 months	PI	Vaginal hair and odor
		NR	5 years	NR	Vaginal atresia
		NR	2 years	NR	Corpus spongiosum with irregular urination
		NR	9 months	NR	Granulation tissue
Negenborn 2017 [197]	1	18	24 hours	CO	Necrotizing fasciitis/death
Elfering 2017 [198]	1	24	18 months	PI	Herpes simplex
Labanca 2017 [199]	1	19	1 year	PI	Vulvar condyloma
Thewjitcharoen 2018 [200]	1	28	18 months	CO	Bowel obstruction and hemorrhagic necrosis
DeHaseth 2018 [201]	5	30	12 months	PI	Neovaginal candidiasis
		47	20 months	PI	Neovaginal candidiasis
		30	14 months	PI	Neovaginal candidiasis
		61	1 month	PI	Neovaginal candidiasis
		25	3 months	PI	Neovaginal candidiasis
Bollo 2018 [202]	1	78	45 years	PI	Squamous cell carcinoma

†Vaginoplasty type: PI= penile-inversion, CO=colo/intestinal, SS= split skin graft

***NR=not reported**

Prospective Studies

Thirty-four studies included a prospective design to investigate longer term vaginoplasty outcomes; these used various methods to investigate the impact of surgery on medical and psychosocial outcomes, including pre-post measures of change, the use of concurrent and historical comparison groups as well as comparisons to normative population data. One study compared outcomes among individuals offered early or delayed surgery and found significant improvements in social and work activity among the group that had undergone early surgery[13] Three studies compared outcomes in transgender people postoperatively to cisgender people or community level data [203-205] while others compared pre- and post-surgical measures without an external comparison group. Women were evaluated between 0.5 and 23 years after undergoing surgery. The studies and outcome measures are summarized in Table 5.

Early studies focused on the impact of surgery on psychosocial functioning. Measures of success were demonstrated by the woman maintaining or improving employment prospects, being in a relationship and preferably married to a cisgender man, blending into society, not socializing with transgender people and avoiding criminal activities. Hunt 1979[147] and Ross[107] both used the Minnesota scale that assessed postoperative women in 5 domains: Economic adjustment, interpersonal relationships, psychopathology, sexual adjustment and family reactions. Although modest improvements were seen in most domains, the surgery did not positively impact on employment or psychopathology, which included subcategories of mental status, drug use and legal problems such as criminal activities.

Many of the studies investigated the aesthetics of the genitals after surgery. Aesthetics were measured in different ways, including asking women about overall satisfaction [105, 107, 108, 111-113, 117, 120, 122, 124, 126, 128, 129, 133-140] and more specifically about

satisfaction with the appearance of the new genitals.[107, 108, 110, 112, 113, 115, 117, 120, 121, 132, 133, 143, 206] In all of the studies the vast majority of women were highly satisfied with the aesthetics of their surgery by whatever standard was used.

Some studies attempted to use a more objective measure by having the surgeons or other professionals rate the appearance of the neovagina and external genitals, either by rating photos or doing a pelvic exam.[108, 111, 113, 120, 123, 133]. In one study lay people as well as professionals rated the photos, with cisgender women giving the lowest scores of all raters.[123] In recent years several studies have used scales validated in cis-women such as the Female Genital Self-Imaging Scale (FGSIS).[207] These have shown high scores when applied to postoperative transgender women and similar to normative data in cisgender women.[123, 167, 204, 208]

Another documented measure of successful surgery included having adequate vaginal dimensions (width and length). Several studies accomplished this by asking women if they were satisfied with the length/size of the vagina. In all studies women were highly satisfied.[107, 112, 115, 117, 122, 124, 133, 143, 206] In other studies the surgeons measured the vagina using vaginal stents or dilators.[108, 113, 117, 133, 208] At times this did not correlate with the patients' viewpoint. In general women were usually satisfied, even if the surgeon documented a "short" vagina.[133]

Sexual function and orgasm were studied by most of the investigators. The rates of orgasm ranged from to 50-96%.[110-112, 115, 117, 120, 130, 134, 140, 142, 209-211]

Quality of life (QOL) was measured using different scales, including the Short Form 36 (SF-36) Health Survey),[212] the World Health Organization Quality of Life (WHOQOL-

100),[213] the QOL Fragen zur Lebenszufriedenheit Module [FLZM][214] and The King's Health Questionnaire.[215] QOL appeared to improve after surgery, [131, 141, 144, 203-205, 216, 217] although scores were sometimes lower than the general population at baseline.[205, 217]

In addition to QOL, several studies have also evaluated happiness and well-being, using The Subjective Happiness Scale,[218] Satisfaction With Life Scale and [219] Cantril's Ladder of Life Scale.[220] Happiness scores stayed the same [132] or improved after surgery.[204] One study objectively examined anxiety and depression. In this study 20 women who had undergone vaginoplasty surgery 2 years prior were compared to 20 who were awaiting their surgery. At intake and at standard timepoints the Crown Crisp Experiential Index (CCEI) measured anxiety and anxiety and depression. Women who underwent surgery were found to be more active socially, in sports, more likely to remain employed. The average CCEI scores improved after surgery but declined for those awaiting surgery. [221] A second study, Papadopulos et al. also reported a trend to lower depression/anxiety scores postoperatively ($p < 0.01$).[141]

The Female Sexual Function Index[222] is a scale validated in cisgender women that scores sexual desire, frequency of sexual intercourse, arousal, satisfaction, lubrication, emotional closeness and pain. The scores among transgender women who had undergone

vaginoplasty were usually lower than corresponding normative values in cisgender women [123, 135, 204, 223] and reached normal values in two studies.[131, 167]

Table 5: Prospective Studies: Outcome measures

Author/Year	Country	Sample size	Time since surgery	Outcome Measures
Hunt 1979[147]	USA	17	Average 8.2 years	Psychosocial scale: economic adjustment, interpersonal relationships, psychopathology, sexual adjustment, family reactions
Sorensen 1981[105]	Denmark	23	Average 6 years (1-23)	Psychosocial scale: employment, marital status, social contacts, somatic conditions, psychiatric conditions, sexual life
Kuiper 1988[132]	Netherlands	55	Average 5.5 years (1 month-14.8 years)	Subjective wellbeing, self-perception, satisfaction with behavior, integration of gender role, confidence in gender role, body satisfaction, regret, suicidality
Blanchard 1987[133]	Canada	22	Average 4.4 years (0.5-11.8 years)	Aesthetics, vaginal depth and width, sexual function
Ross 1989[107]	Australia	14	Average 3.7 years	Aesthetics, vaginal dimensions, psychosocial scale (Hunt and Hampson)[224]: economic, interpersonal relations, psychopathology, sexual adjustment
Stein 1990[120]	USA	10	5-48 months	Aesthetics, functional outcome, dilator use, psychosocial scale: economic, social, sexual
Mate-Kole 1990[221]	UK	20		Crown Crisp Experiential Index[225], Bern Sex Role Inventory[226], psychosocial scale: social, economic, sexual
Van Noort 1993[108]	Netherlands	27	1-103 months	Aesthetics, function, vaginal dimensions, sexual life
Rakic 1996[134]	Serbia	22	≥ 6 months	Psychosocial (Adjustment to Sex Reassignment Surgery Questionnaire): attitude to body, relationships, sexual activity, occupational functioning

Eldh 1997[130]	Sweden	40		Aesthetics, function, psychosocial: sexual identity, family relationships, employment, economic situation
Rehman 1999[110]	USA	28	≥ 3 years	Aesthetics, function, sexual life, satisfaction with surgery, quality of life, psychosocial: relationships, employment adjustment
Perovic 2000[111]	Serbia	89	Average 4.6 (0.25-6) years	Aesthetics, function, vaginal dimensions, sexual life, psychosocial
Krege 2001[112]	Germany	31	≥ 6 months	Aesthetics, function, sexual life
Kwun Kim 2003[113]	South Korea	26	Average 5 years (1-10 years)	Aesthetics, function, vaginal dimensions, mucus, odor, sexual life
DeCuypere 2005[142]	Belgium	32	≥ 1 year	Biographical Questionnaire for Transsexuals and Transvestites,[227] Body Image Scale,[228] satisfaction with surgery, sexual life, sexual relationships
Lobato 2006[229]	Brazil	18		Sexual life, sexual relationships, relationship with family members
Goddard 2007[115]	UK	70	Average 56 (8–351) days	Aesthetics, function, sexual life
Imbimbo 2009[143]	Italy	139	12-18 months	Aesthetics, function, sexual life, satisfaction with surgery, psychosocial: employment, family status, personal relationships, social/cultural life
Weyers 2009[135]	Belgium	70	≥ 6 months	Physical and mental health (SF-36 Short Form 36 Health Survey),[212] body image, Female Sexual Function Index, sexual life,[222] sexual relationships
Kuhn 2009[203]	Switzerland	52	Average 15 years (8-23)	King's Health Questionnaire,[215] quality of life, health and satisfaction

Parola 2010[144]	France	15	≥ 2 years	Physical and mental health (SF-36 Short Form 36 Health Survey),[212], Eysenck Personality Inventory[230]
Amend 2013[117]	Germany	24	Average 39.7 months (16-69	Aesthetics, function, vaginal dimensions, sexual life
Tavakkoli 2014[121]	Iran	112	13.3±6.7 months	Aesthetics, function, satisfaction, sexual life
Morrison 2015[122]	USA	83	Average 2.2 years	Aesthetics, function, satisfaction, sexual life
Buncamper 2015	Netherlands	49	4.1 ± 1.0 years	Aesthetics, Female Sexual Function Index (FSFI),[222] the Amsterdam Hyperactive Pelvic Floor Scale—Women (AHPFS-W), the Female Genital Self-Imaging Scale (FGSIS),[207] and short questionnaire for self-evaluation of vaginoplasty
Castellano 2015[131]	Italy	60	2-33 years	World Health Organization Quality of Life (WHOQOL-100),[213]
Bouman 2016[204]	Netherlands	31	Average 2.2 years	Subjective Happiness Scale,[218] Cantril's Ladder of Life Scale,[220] Satisfaction With Life Scale,[219] the Female Genital Self-Imaging Scale,[207] the Female Sexual Function Index,[222] the Amsterdam Hyperactive Pelvic Floor Scale—Women, postoperative satisfaction survey.
Cardoso 2016[216]	Brazil	47	≥ 1 year	World Health Organization Quality of Life Assessment (WHOQOL-100)[213]
Lindqvist 2016[217]	Sweden	190	1, 3, and 5 years≥	Short Form-36 Health Survey (SF36)[212]
Papadopulos 2017[205]	Germany	47	average 19 months	Quality of Life - QOL Fragen zur LebenszufriedenheitModule [FLZM][214]; Self-developed questionnaire: aesthetics, function, socioeconomic issues and postoperative satisfaction

Buncamper 2017[208]	Netherlands	100	Average 1.8 years (range, 1.0 to 3.7 years	Aesthetics, function, satisfaction, vaginal dimensions, sexual life, the Female Sexual Function Index,[222] the Female Genital Self-Imaging Scale (FGSIS),[207]
Manrique 2017[111, 167]	Thailand	15	≥ 1 year	The Female Sexual Function Index[222], The Female Genital Self-Image Scale. [207]
Zavlin 2018[206]	Germany	40	6 months	Self-developed scale: Esthetics, function, satisfaction, sexual life
Massie 2018[124]	Netherlands	117	21 months (13-24)	Aesthetics, function, satisfaction, sexual life

3.4 Discussion

Overview of Included Studies

The goal of a scoping review is to map the existing published literature, summarize research findings and identify gaps and opportunities for future research. One of the strengths of this review was inclusion of a wide range of study designs, including case reports/case series, retrospective and prospective studies, that could provide comprehensive health outcomes data at different timepoints for transgender women who had undergone vaginoplasty surgery. The number of publications describing clinical outcomes increased five-fold from the 1970s to 2000s, possibly reflecting improved insurance coverage, greater access to trained surgeons as well as greater visibility and acceptance of transgender people. This is consistent with studies showing a greater number of gender-affirming genital surgeries over the last 5 years.[91, 92] Most of the studies were undertaken in Europe and North America. Many of the papers were published in English, therefore the majority of papers on this subject were included. The paucity of published research from other regions may reflect the high levels of discrimination and restricted health care access for transgender people in many countries worldwide.[58]

Case reports, although considered to be low quality in the epidemiologic hierarchy (behind clinical trials, observational cohort studies and case control studies) and subject to bias, provided a valuable tool to investigate uncommon postsurgical complications of a relatively rare surgery.[231, 232] As demonstrated by the 36 case reports, serious complications can occur decades after surgery - one woman presented with problems well over 4 decades after her vaginoplasty surgery.

Among people who have intra-abdominal surgeries, most reported adverse effects occurred during hospitalization and usually very early in the postoperative period (within the

first 3 days).[233] Transgender patients who have vaginoplasty surgery usually stay in the hospital for 5-7 days, thus most early complications should be captured by review of medical records. The published retrospective studies, predominately using chart review data, provided postsurgical follow up of patients for a range of 6 months to 13 years.

Challenges with Measurement of Surgical Outcomes

In the studies reviewed, reporting of adverse events was not uniform. Although some authors published comprehensive lists of complications with associated frequencies, others only provided a list but no rates of complications so that incidence of adverse outcomes could not be calculated. It also was unclear in many studies whether complications were listed by occurrence or by patient, i.e., how the authors captured the data if a person experienced a complication more than once. Many of the studies relied on review of medical records which may be incomplete and not adequately capture all variables. Although serious health issues, e.g., bleeding requiring transfusion, death and thromboembolic events are likely to be documented, less serious conditions may not be documented sufficiently, if at all.

Postoperative outcomes were measured using multiple methodologies, making it difficult to compare these across studies or over time. Authors investigating aesthetics of the genitals after vaginoplasty at times used subjective measures such as documenting patient satisfaction,[110, 112, 143] or attempted to apply objective measures, such as standardized physical examinations by the surgeon[108, 111] or scoring of photographs by professionals or lay people.[114] These last measures were possibly biased, especially with the surgeon or their colleagues grading the aesthetics of the surgeries they had performed. Vaginal depth for example could be measured subjectively by asking the patient if depth was sufficient[112, 117, 143] or by measuring with different sized dilators.[108, 113]

Psychosocial and Psychosexual Measures

The ultimate goal of gender affirming surgeries is to align the body with a person's gender identity and thereby to resolve gender dysphoria. Development of appropriate and validated psychosocial scales is an important tool to demonstrate efficacy of surgery to reduce gender dysphoria.

In 1978 The University of Minnesota published methods to evaluate long-term outcomes for transgender women who had undergone vaginoplasty at their institution.[234] Each woman was to be her own control with monitoring of pre and post-surgery scores in 4 domains - economic, sexual and social outcomes. The highest "A" social score related to the ability of a person to blend into cisgender society, no longer having transgender friends, whereas a "D" score was for those engaging in "striptease dancing" with "multiple arrests by the morals squad" and "an undesirable 'mess'". This set the tone for outcome measures over the next decade.

In this review there were few prospective studies that used objective psychosocial measures, especially in the earlier reports. Many were subjective and only allowed for yes/no categorical responses, e.g., whether the woman felt more feminine after surgery or if relationships with her family had improved. Some of the measures were vague such as ratings of "satisfaction with surgery" which could apply to either aesthetics or function. It was also unclear how some of the measures were related to surgery, for example the questions asking about job stability, marriage or arrest records.

Some of the validated scales for sexual function developed for cis-populations have not been validated in transgender people, one example being the Female Sexual Function Index (FSFI).[222] This index includes a score that assesses lubrication which is not physiologically

possible with split skin or penile inversion vaginoplasty, thereby artificially lowering scores. This and other scales may need to be appropriately tested and modified in transgender populations.

Limitations

As in any review, it is possible that some published literature was missed. In addition, the review did not explore gray literature such as clinic or hospital reports or conference abstracts, all of which may have contributed important information. Although this review provides the first comprehensive summary of perioperative complications that have been attributed to vaginoplasty surgery, it is likely an under-estimate of the true number of complications, especially long-term adverse events. Transgender people may avoid health care due to previous instances of health care discrimination or anticipated stigma and may be less likely to seek preventive care, leading to delayed diagnoses.[39, 60]

3.5 Conclusions and Recommendations

In this scoping review to examine gender-affirming genital surgeries among transgender women, we identified over 100 research publications spanning a period of almost 4 decades, predominately from US and European based centers. Although there were multiple reports that addressed clinical outcomes and complications, many were low quality evidence, with over a third of the articles being case reports. There are currently few high-quality studies addressing the impact of these surgeries on general health and wellbeing. However, the review also demonstrated that in the last 5 years there has been an increase in studies using standardized and consistent outcome measures.

This review underscores the need for further research in this area. One recommendation would be to create registries for people undergoing these surgeries to improve tracking and valid measurement of clinical outcomes. Additionally, improved identification of transgender people in health care settings is needed since the current methods rely heavily on the use of diagnosis codes for gender identity disorder. The Williams Institute as well as other centers have advocated the use of the two-step question that asks about gender identity as well as sex assigned at birth.[66] This method has been validated to improve identification of transgender people.[65, 235] Lastly there is a need for consistent and validated measures to evaluate short and long term outcomes after gender affirming surgeries.

Since an increasing number of people are expressing an interest in gender-affirming surgery[60], it is important to provide clinicians with the resources and knowledge to deliver optimal and evidenced based care to transgender patients including those who access gender affirming interventions.

Chapter 4: Sexually Transmitted Infections among Transgender People

4.1 Background

Transgender people, i.e., individuals who have a gender identity that differs from the sex that they were assigned at birth are gaining more visibility in research and health settings.[6, 58] A recent meta-regression analysis indicated that approximately one million adults in the United States (US) aged 18 years and older (0.4% of the adult population) identify as transgender[1] with an estimated 25 million adults worldwide. A higher proportion of youth, almost 2% of high school students, identify as transgender.[59] Although there are no US population-based estimates for the prevalence of gender nonbinary people, approximately 35% of the 27,715 respondents of the 2015 U.S. Transgender Survey (USTS) identified as gender nonbinary.[60]

Transgender women ("trans women" or "women of transgender experience") are women who were assigned male at birth (i.e., born with male anatomy). Transgender men ("trans men," or "men of transgender experience") are men who were assigned female at birth (i.e., born with female anatomy). Some individuals may identify outside the gender binary of male or female or move back and forth among different gender identities and use terms such as gender nonbinary, genderqueer, gender nonconforming or gender fluid to describe themselves. Agender or null-gender persons do not identify with having any gender. The terms cisgender is used to describe persons who identify with their assigned sex at birth.

Gender identity is independent from sexual orientation and sexual behavior. Transgender people might have sexual partners who are cisgender men, cisgender women, or other transgender or gender nonbinary people. Sexual orientation identities among transgender people

are diverse and in the USTS respondents predominately identified as queer (21%), pansexual (18%), gay/lesbian/same gender loving (16%), bisexual (14%) or asexual(10%).[60]

Some transgender individuals may seek medical (hormonal and/or surgical) interventions in addition to social or legal changes, e.g., changing their name and/or gender marker.[6] The incidence of gender-affirming genital surgeries conducted in the U.S. has increased in the last decade.[92]

Transgender people often experience high rates of stigma, socioeconomic and structural barriers to care that negatively impact healthcare utilization, increase susceptibility to human immunodeficiency virus (HIV) and sexually transmitted infections (STIs) and incur missed opportunities for HIV and STI prevention services.[9-16]. Transgender women carry elevated risk factors for HIV and other STIs including high rates of sex work (often exceeding 50%), condomless anal receptive sex, early sexual debut and high numbers of predominately cisgender men sexual partners. [17-23]. Although less is known about transgender men, studies have also demonstrated risk factors such as engaging in sex work, condomless sex with cisgender men and low rates of STI screening. [15, 34-37]

A recent systematic review and metanalysis of HIV among transgender women estimates the US prevalence of HIV to be 14% among transgender women with the highest prevalence among black (44%) and Hispanic/Latino (26%) transgender women.[24] Data also suggest high rates of HIV among transgender women globally.[25] The few studies of HIV prevalence and incidence in transgender men suggest that they have a lower prevalence of HIV than transgender women, approximately 2%.[24]

Data on bacterial STIs among transgender women are limited due to the lack of widespread and consistent reporting of national surveillance data that includes gender-identity.[236] Many studies reporting on STIs have therefore used clinic data or convenience samples. Despite limited data, international and US studies indicate elevated incidence and prevalence of rectal and pharyngeal (extragenital) *Neisseria gonorrhoeae* (GC) and *Chlamydia trachomatis* (CT) infections among transgender women, similar to and frequently exceeding the rates seen among cisgender men who have sex with men (MSM).[23, 237-239] Other STIs, including syphilis, hepatitis B and C have also been reported among transgender women at high rates.[240-243]Among transgender men the highest STI risk occurs among those who have sex with cisgender men (known as trans MSM).[15] Transgender men have been found in a few small studies to have similar rates of GC, CT, hepatitis B and C compared to transgender women.[35, 244, 245] There are few data about the rates of STIs among gender nonbinary people. An evaluation of electronic health record data from 19 933 patients visiting a health center in Los Angeles, California found that STI positivity was 35% among gay and bisexual cisgender men, 25% among transgender women, 13% among gay and bisexual transgender men and 26% among nonbinary people.[246] Another study demonstrated elevated CT positivity in the last year among gender nonbinary people compared to cisgender men who have sex with men (MSM).[247] A recent high quality study using data from the Sexually Transmitted Disease (STD) Surveillance Network obtained STI prevalence among 506 transgender women and 120 transgender men attending STD clinics in 25 jurisdictions across the U.S. Extragenital CT and GC infections were seen in 16.8% and 15% of transgender women and 14.3% and 12.1% of transgender men respectively. The rates of urogenital infections were 0.2%, 2.8% among transgender women and 4.1% and 7.1% among transgender men.[248] The proportions of

transgender people with extragenital chlamydia or gonorrhea infections were similar to those of cisgender MSM.[248] It was not possible in this large study to investigate the incidence and prevalence of GC or CT infections in gender nonbinary people or in transgender people who had undergone genital surgery as data about nonbinary identities or surgeries were not documented.

Most transgender women have not undergone genital gender-affirmation surgery and therefore still have a penis. They many engage in insertive oral, vaginal, or anal sex as well as receptive oral or anal sex. In the USTS 12% of transgender women had undergone vaginoplasty surgery and about half expressed an interest in having the surgery in the future.[60] The majority of vaginoplasty surgeries conducted in the US use penile and scrotal tissue to create the neovagina.[85, 249] Other surgical techniques use intestinal tissue (e.g., sigmoid colon graft) or split skin grafts.[88, 89] Although these surgeries involve penectomy (removal of the penis) and orchiectomy (removal or testes), the prostate remains intact. Transgender women who have had a vaginoplasty might engage in receptive vaginal, oral or anal sex. Neovaginal STIs have infrequently been reported in the literature and include Herpes simplex infection of the neo-labia and human papilloma virus (HPV)/genital warts (in penile-inversion vaginoplasty) and *Neisseria gonorrhoeae* (in both penile-inversion and colo-vaginoplasty) of the neovagina.[170, 177, 182, 198, 199, 250, 251] If the vaginoplasty used an intestinal graft there is additionally a risk, albeit rare, of bowel-related diseases such as inflammatory bowel disease, adenocarcinoma, diversion colitis and adenomatous polyps.[252-254]

Transmasculine individuals may undergo genital gender affirmative surgeries, including construction of a neophallus (metoidioplasty or phalloplasty) and related surgeries including hysterectomy, oophorectomy, scrotoplasty and vaginectomy. The USTS indicated that the proportion of transgender men and non-binary individuals assigned female at birth who have

undergone gender affirmative genital surgery is low. Only 5% of transgender men had undergone phalloplasty or metoidioplasty; however, 44% planned to have it one day.[60] Many surgical options exist for transgender men and these are usually individualized to address the specific needs of each patient. For example, an individual can undergo a metoidioplasty (a procedure to increase the length of the clitoris), with or without urethral lengthening, and may or may not have a hysterectomy, oophorectomy or vaginectomy.[85, 255] Urethral lengthening is a procedure that involves creation of a competent urethra using buccal or vaginal mucosa and that allows persons to void while standing. The phalloplasty technique uses skin usually from the forearm, thigh, chest wall or abdomen to create a phallus. There are no published reports of sexually transmitted infections of the neophallus.

There are limited data both about STI screening behaviors as well as STI prevalence among transgender people of all gender identities, including gender nonbinary people. To our knowledge, there are no data on these variables that are specific to people who have undergone genital surgeries. The aim of this report therefore is to examine rates of screening behaviors and prevalence of HIV, syphilis, GC and CT infections in transgender people using retrospective chart review data from a community health center in New York City (The Transgender Data Project). The prevalence of STIs and HIV are also compared among transgender men, transgender women and gender nonbinary people and rates of infections among those who have received GAHT or undergone gender affirming surgeries “medical gender-affirmation”.

4.2 Methods

Sample and Setting

This study used data from the Callen-Lorde Community Health Center (CLCHC) and has been described in detail previously (Chapter 2). To summarize, this was a retrospective chart review

of transgender and gender nonbinary patients to answer questions about the health status of transgender clients ≥18 years old, using data gathered from the electronic health records between 1/12009 and 12/31/2010.

Subjects were registered patients 18 years of age or older treated at the CLCHC between 1/12009 and 12/31/2010.

Inclusion Criteria:

1. A patient treated at the health center between 1/1/2009 and 12/31/2010

2. Identified as transgender

3. Age 18 or older

4. No subject to be excluded from the study on the basis of gender, racial or ethnic origin.

STI and HIV screening tests were determined from orders and results in the electronic health record. Hormone usage was determined from the medication lists. The social history template contained information on sexual partners, sex work and cigarette use. Medical diagnoses, e.g., substance use disorder, were available from ICD codes in the diagnosis template. Information was collected and stored in a password-protected electronic database. The medical record numbers were de-identified to protect patient confidentiality. There was no key or linking list to allow matching of patient or patient identifiers to the database.

This retrospective chart review (termed the Transgender Data Project on the application) obtained IRB approval from The Clinical Directors Network's institutional review board on September 7, 2011.

Comparison with the New York City Community Health Survey

The use of the New York City Community Health Survey (NYC CHS) as a comparison group was outlined in detail in Chapter 2. Every year the New York City Department of Health and Mental Hygiene conducts a community health survey (NYC CHS) of non-institutionalized adults who are 18 years and to better understand health care factors as well as risk behaviors. [62] The NYC CHS was used to provide a comparison of HIV screening rates. As in chapter 2, NYC CHS participants who were engaged in care (could identify one or more primary care providers) were included in the analysis. The data set was merged with data from CLCHC allowing for a comparison of the proportions of people from both sources undergoing HIV screening

Analysis

The prevalence of the health conditions and screenings was calculated overall and also separately by birth-sex and age category. Pearson chi-square tests or Fisher's exact tests for cell counts ≤5 was used to compare categorical variables by birth sex and independent sample t-test to compare continuous variables by birth sex. Multivariable logistic regression models were used to assess the associations among gender identity and STI/HIV screening and gender identity and any STI or HIV positive diagnosis. All p-values are two-tailed at a significance level of 5%. Analyses were performed using IBM SPSS Statistics for Windows, Version 26.0

4.3 Results

A total of 3,197 records were initially retrieved. These were reviewed manually and 1670 of the records were identified as those of transgender patients. In 2010, CLCHC had 14,961 unique patients, therefore the prevalence of transgender patients at the center was 11.2%. The 1670 transgender people included 1093 who documented their assigned sex at birth as male, 577 who

documented their assigned sex at birth as female. Two intersex individuals were not included in subsequent analyses, Table 1

Table 1: Documentation of gender identity in electronic health records

	Assigned Sex at Birth					
	Male		**Female**		**Total**	
Gender Identity	n	%	n	%	n	%
Male	2	0.2	88	15.3	90	5.4
Female	113	10.3	0	0	113	6.8
Genderqueer	2	0.2	24	4.2	26	1.6
FTM	0	0	14	2.4	14	0.8
MTF	13	1.2	0	0	13	0.8
Transgender	13	1.2	11	1.9	24	1.4
Transgender female/woman	885	81.0	0	0	885	53.0
Transgender male/man	0	0	413	71.6	413	24.7
Transsexual	39	3.6	7	1.2	46	2.8
Gender nonconforming	1	0.1	3	0.5	4	0.2
Other	25	2.3	17	2.9	42	2.5
Total	**1093**	**100**	**577**	**100**	**1670**	**100**

Demographics and Health Indicators

The mean age of the sample was 35.57 years, SD 11.54, range 18.0-85.1). Transfeminine and transmasculine individuals differed significantly by age, race, education and employment. Transfeminine individuals were on average 37.4 years old (range: 18.0-85.1) while transmasculine individuals were approximately 5 years younger, p<.001. Transmasculine individuals were predominately white (55.0%) whereas transfeminine individuals were more likely to be people of color (71.3%), p<.001. The two populations differed in other ways, including rates of education. Transmasculine individuals were more highly educated with 95.1% having at least a high school diploma, 33.1% having a 4-year college degree and 18.7% holding a graduate degree compared to 84.1%, 17.7% and 6.6% among transfeminine individuals, p=<.001. Unemployment rates were much higher among transfeminine people – 28.7% among transmasculine and 46.4% among transfeminine people, p<.001. While both groups had similar rates of being uninsured (12.2% and 14.1%, p=.323) the types of insurance were different with transmasculine individuals twice as likely to have private insurance, p<.001. Transmasculine individuals were more likely to report stable housing vs. unstable/homeless 96.6% vs. 93.5%, p=.012, Table 2

Table 2: Demographic and other socioeconomic variables among transgender patients

	Transmasculine (n=577)		Transfeminine (n=1093)		All (n=1670)		t-test (df)	p-value (2-sided)
Mean age in years (SD) Range	32.15 (9.31) (18.3-70.5)		37.38 (12.18) (18-85.1)		35.57 (11.54) (18.0-85.1)		-9.022 (1668)	<.001
Race/Ethnicity	%	n=496	%	n=942	%	n=1438	$\chi 2$ (df)	<.001
Hispanic	11.7	58	29.4	277	23.3	335	114.38 (4)	
White	55.0	273	28.7	270	37.8	543		
Black	13.9	69	21.3	201	18.8	270		
Asian/Pacific Islander	5.8	29	7.4	70	6.9	99		
Other	13.5	67	13.2	124	13.3	191		
Education (highest level)	%	n=493	%	n=843	%	n=1336	132.82 (4)	<.001
Less than High School	4.9	24	15.9	134	11.8	158		
High School Diploma	11.8	58	25.3	213	20.3	271		
Some College	31.6	156	34.5	291	33.	447		
Bachelors' Degree	33.1	163	17.7	149	23.4	312		
Graduate degree	18.7	92	6.6	56	11.1	148		
Unemployment	%	n=540	%	n=962	%	n=1502	44.93 (1)	<.001
	28.7	155	46.4	446	40.0	601		
Housing (stable)	%	n=526	%	n=939	%	n=1465	6.25 (1)	.012
	96.6	508	93.5	878	94.6	1386		
Insurance	%	n=599	%	n=944	%	n=1443	147.60 (2)	<.001
Uninsured	12.2	61	14.1	133	13.4	194		
Private	60.5	302	28.6	270	39.6	572		
Public	27.3	136	57.3	541	46.9	677		

Sexual Partners

Sexual health was first examined by investigating the sexual partners of transmasculine and transfeminine people as documented in the electronic health records, specifically whether their partners were cisgender or transgender men or women. The sexual partnerships in the study were diverse and individuals could have sex partners of more than one gender. Table 3

Transmasculine individuals partnered most frequently with cisgender women (63.6%), followed by cisgender men (32.1%). Transgender women were slightly more likely to have sex partners that included cisgender men (64.3%) while 16.6% partnered with cisgender women, Table 5. Transfeminine individuals reported higher rates of sex work 5.5% vs. 0.3%, p<.001 compared to transmasculine people.

Table 3: Gender identity and gender of sex partner*

Sex partner	Transmasculine n=577	Transfeminine n=1093	All n=1670
Cisgender male	185	703	888
Cisgender female	367	181	548
Transgender male	18	6	24
Transgender female	8	7	15
None	52	122	174
Missing	83	125	208

*Not mutually exclusive

HIV Screening and Prevalence

Just over half of all transgender people in this study had undergone screening for HIV (55.7%). Rates of HIV screening among transfeminine individuals were higher (62.2% vs. 43.4%, p<.001)

than for transmasculine individuals. HIV prevalence was 28.1% among transfeminine and 2.8% among transmasculine individuals (p<.001). Table 4

Screening for Sexually Transmitted Infections

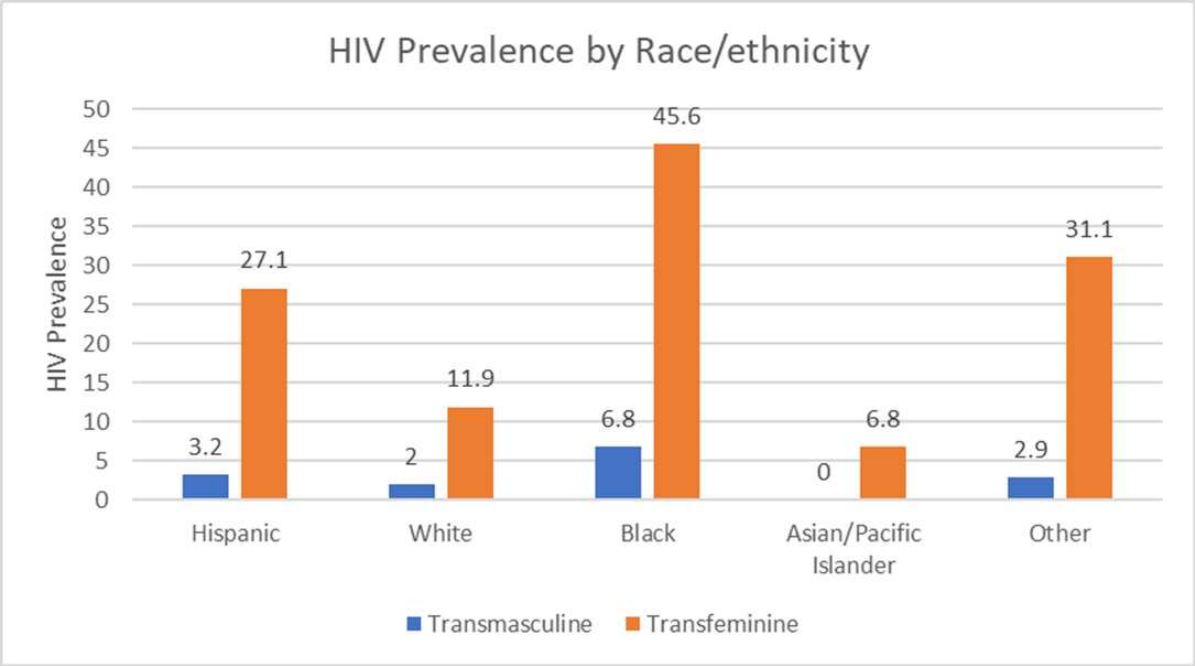
Syphilis testing, using the rapid plasma reagin (RPR) test was done in fewer than half (44.8%) of transgender people and differed by gender identity. 40.1% of transmasculine and 47.3% of transfeminine individuals were screened (p=.005). No syphilis diagnoses occurred among transmasculine individuals however 5.6% of transfeminine people had a reactive RPR, p<.001. GC and CT testing occurred in 9.7% of transmasculine and 9.5% of transfeminine individuals (p=.800). There were no GC diagnoses among transmasculine individuals and only 1 case of CT (1.8%) whereas 4.9% of specimens tested positive for GC (p=.162) and 6.9% for CT among transfeminine individuals (p=.261). Genital warts were diagnosed in 2.8% of transmasculine and 6% of transfeminine individuals, p<.001. Table 4

Table 4: HIV and STI risk factors, screening and prevalence among transgender patients

	Transmasculine (n=577)		Transfeminine (n=1093)		All (n=1670)		t-test (df)	p-value (2-sided)
Sex work	%	n=577	%	n=1093	%	n=1670	29.94 (1)	<.001
	0.3	2	5.5	60	3.7	62		
Substance use Disorder	n=577		n=1093		n=1670		6.74 (1)	.009
	3.1	18	6.0	66	5.0	84		
HIV testing	n=558		n=1055		n=1613		52.33 (1)	<.001
	43.4	242	62.2	656	55.7	898		
Syphilis testing	n=576		n=1092		n=1668		7.99 (1)	.005
	40.1	231	47.3	517	44.8	748		
Gonorrhea/chlamydia testing	n=576		n=1092		n=1668		.064 (1)	.800
	9.7	56	9.3	102	9.5	158		
All STD testing	n=576		n=1092		n=1668		7.99 (1)	.005
	40.3	238	49.1	536	46.4	774	9.14 (1)	.002
Sexually transmitted infections								
Gonorrhea	n=56		n=102		n=158		2.84 (1)	.162
	0	0	4.9	5	3.2	5		
Chlamydia	n=56		n=102		n=158		1.94 (1)	.261
	1.8	1	6.9	7	5.1	158		
Genital warts	n=577		n=1093		n=1670		8.63 (1)	0.003
	2.8	16	6.0	66	4.9	82		
Syphilis	n=231		n=517		n=748		13.48 (1)	<.001
	0	0	5.6	29	3.9	29		
HIV	n=250		n=672		n=922		69.82 (1)	<.001
	2.8	7	28.1	189	21.3	196		
Hormones	n=577		n=1093		n=1670		5.57 (1)	.018
	78.9	455	83.5	913	81.9	1368		

These data on HIV prevalence differed significantly by race. Among transfeminine individuals the prevalence was highest among people of color, 31.4% vs. 11.9%, p<.001. African American transfeminine individuals were three times as likely to be living with HIV with a prevalence of 45.6% compared to 21.2% among non-Black individuals (OR=3.12, 95% confidence interval: 2.06, 4.69; p<.001). Among transmasculine people HIV seroprevalence was 3.2% among Hispanic, 6.8% among African American and 2.1% among white individuals, although these differences were not statistically significant (p= .597). Figure 1

Figure 1: HIV Prevalence by Race/ethnicity



Since the sexual transmission of HIV among transmasculine individuals is greater among those who identify as gay or bisexual and have sex with cisgender men, the prevalence of HIV was investigated by sex partner status. HIV seroprevalence was highest for those with cisgender male partners. The overall rate of HIV among transfeminine individuals was 28.1%, 29.8% among

those with cisgender male partners only and 10% among those with cisgender female partners only (p=.003). The prevalence of HIV among transmasculine individuals who have sex exclusively with cisgender men was 11.1% vs. 2.1% in those who had sex exclusively with cisgender women. (p=.121). The HIV seroprevalence was not statistically different between transmasculine and transfeminine individuals whose sex partners were exclusively cisgender men, p=.113, Table 5

Table 5: HIV status by gender identity and gender identity of sex partners

	Transmasculine			Transfeminine			All				
Sex partners	n	HIV +	%	n	HIV+	%	n	HIV+	%	χ2 (df)	p-value†
Any	250	7	2.8	672	189	28.1	922	196	21.3	69.82 (1)	<.001
Cisgender male only	18	2	11.1	460	137	29.8	478	139	29.1	2.93 (1)	.113
Cisgender male + other	86	3	3.5	498	142	28.5	584	145	24.8	24.61 (1)	<.001
Cisgender female only	94	2	2.1	50	5	10	144	7	4.9	4.37 (1)	.049
Cisgender female + other	163	3	1.8	90	10	11.1	253	13	5.1	10.22 (1)	.002

†Reported p-values are from Fisher's exact tests when cell sizes are less than 5

Utilization of Gender-affirming Care

The rates of gender affirming care including hormone therapy and surgeries were examined by gender identity. Eighty-two percent of all transgender people had accessed hormones, either testosterone for transmasculine or estrogens for transfeminine individuals. Transfeminine individuals were more likely to have accessed hormones, 83.5% vs. 78.9%, p=.018.

Transmasculine surgical interventions included mastectomy, phalloplasty or metoidioplasty, hysterectomy and oophorectomy. Transfeminine surgeries included breast augmentation, orchiectomy, vaginoplasty and facial feminization surgery. Although these surgeries could not be directly compared, a variable for "any surgery" was created. Transmasculine individuals were more likely to undergo at least one gender affirming surgery (41.6% vs. 26.2%, p<.001) however transfeminine individuals were more likely to have received either hormones or surgery i.e., "any gender affirming intervention" (86% vs. 82%, p=.030). Table 6. One of the research questions was to investigate the prevalence of STIs among people who had undergone genital surgery. Transfeminine people who had undergone vaginoplasty were compared to those who had not. The rate of genital warts was lower in those who had surgery (6.7% vs. 0%, p=.002) and there was also a statistically significant lower prevalence of HIV among those who had vaginoplasty (30% vs. 9.7%, p<.001). There was no association between STIs and orchiectomy only. Table 7

Transmasculine individuals had a lower rate of genital surgeries and also low rates of STIs, therefore a meaningful comparison could not be made.

Table 6: Gender affirming care and gender identity

Transmasculine	n=577		Transfeminine	n=1093			
Interventions	N	%	Interventions	N	%	$\chi 2$ (df)	p-value
Hormones (testosterone)	455	78.9	Hormones (estrogens)	913	83.5	5.57 (1)	.018
Mastectomy	227	39.3	Breast augmentation	167	15.3	-	-
Metoidioplasty	6	1.0	Orchiectomy	115	10.5	-	-
Phalloplasty	4	0.7	Vaginoplasty	103	9.4	-	-
Hysterectomy	53	9.2	Facial feminization surgery	98	9	-	-
oophorectomy	45	7.8				-	-
Any surgery	240	41.6	Any surgery	286	26.2	41.66 (1)	<.001
Any gender affirming intervention (hormones/surgery)	473	82	Any gender affirming intervention (hormones/surgery)	940	86	4.70 (1)	.030

Table 7: Vaginoplasty and STI prevalence

	No Vaginoplasty		Vaginoplasty			
	n	%	n	%	$\chi 2$ (df)	p-value†
Syphilis	28	5.8	1	2.9	.5337 (1)	.711
Genital warts	66	6.7	0	0	7.308 (1)	.002
Gonorrhea	5	5.2	0	0	.271 (1)	1.000
Chlamydia	7	7.2	0	0	.387 (1)	1.000
HIV	183	30	6	9.7	11.50 (1)	<.001

†Reported p-values are from Fisher's exact tests when cell sizes are less than 5

Factors Associated with HIV Screening

The HIV screening rate was 57%. In the bivariate analysis for transmasculine individuals, the odds of HIV screening were lower for white individuals (OR=0.48, 95% CI=0.33, 0.69) and among those who were unemployed. There was a trend for increased screening in those who living in unstable housing however this was not significant, p=.601. Receiving hormones (OR=1.64, 95% CI:1.06, 2.53) and gender affirming surgery (OR=1.46, 95% CI:1.04, 2.05) were both associated with increased odds of HIV screening. Other factors associated with HIV screening included having insurance (OR=1.89, 95% CI=1.06, 3.37), a history of genital warts (OR=5.92, 95% CI=1.67, 21.03) and substance use (OR=6.41,95% CI=1.82, 22.55). Age, race, insurance, hormones, gender affirming surgery, genital warts and substance use were entered in the multivariable analysis. After adjusting for all variables, non-white race, gender affirming surgery, substance use and genital warts were all positively associated with an increased odds of HIV screening. Table 8a

For transfeminine individuals, non-white race, having a high school diploma, insurance, cisgender male partner, engaging in sex work, taking hormones, having a history of gender affirming surgery, substance use and genital warts were all associated with increased odds of HIV testing in the bivariate analysis. In the multivariate model analysis, cisgender male partner (OR=2.18, 95% CI= 1.52, 3.11), taking hormones (OR=2.56, 95% CI 1.53, 4.31), gender affirming surgery (OR=1.63, 95% CI=1.10, 2.41), substance use (OR=2.76, 95% CI=1.23, 5.78) and genital warts (OR=3.63, 95% CI=1.83, 7.20) were all associated with increased odds of HIV testing. Table 8b.

Table 8a: HIV screening: Bivariate and Multivariable logistic regression models and transmasculine individuals

Transmasculine				
	Bivariate		Multivariate	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age in years	1.02 (1.00, 1.04)	.074	0.99 (0.97, 1.02)	.500
People of color	1.00		1.00	
White (non-Hispanic)	0.48 (0.33, 0.69)	<.001	**0.39 (0.26, 0.59)**	**<.001**
Employed	1.00		-	
Unemployed	0.81 (0.55, 1.18)	.275	-	
No high school diploma	1.00		-	
High school diploma	0.80 (0.35, 1.81)	.586	-	
Uninsured	1.00		-	
Insured	1.89 (1.06, 3.37)	.031	1.63 (0.83, 3.22)	.160
Stable home	1.00		-	
Unstable home	1.29 (0.50, 3.29)	.601	-	
No cisgender male sex partner	1.00		-	
Cisgender male sex partner	0.94 (0.50, 1.76)	.835	-	
No sex work	1.00		-	
Sex work	1.31 (0.08, 21.0)	.850	-	
No chlamydia	-	-	-	
Chlamydia	-	-	-	
No hormones	1.00		1.00	
Hormones	1.64 (1.06, 2.53)	.028	1.44 (0.79, 2.63)	.232
No gender affirming surgery	1.00		1.00	
Gender affirming surgery	1.46 (1.04, 2.05)	.029	**1.67 (1.08, 2.58)**	**.022**
No substance use	1.00		1.00	
Substance use	6.41 (1.82, 22.55)	.004	**5.18 (1.41, 18.99)**	**0.013**
No syphilis	-	-	-	
Syphilis	-	-	-	
No Gonorrhea	-	-	-	
Gonorrhea	-	-	-	
No genital warts	1.00		1.00	
Genital warts	5.92 (1.67, 21.03)	.006	**4.64 (1.24, 17.34)**	**.023**
No Silicone	-	-	-	
Silicone	-	-	-	

Table 8b: HIV screening: Bivariate and Multivariable logistic regression models and transfeminine individuals

Transfeminine				
	Bivariate		Multivariate	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age in years	1.00 (0.99, 1.01)	.669	1.01 (0.99, 1.02)	.334
People of color	1.00		1.00	
White (non-Hispanic)	0.45 (0.34, 0.61)	<.001	**0.51 (0.35, 0.75)**	**.001**
Employed	1.00		-	
Unemployed	0.97 (0.74, 1.27)	.849	-	
No high school diploma	1.00		1.00	
High school diploma	0.66 (0.44, 1.00)	.047	0.87 (0.52, 1.46)	.605
Uninsured	1.00		1.00	
Insured	1.63 (1.12, 2.37)	.011	1.23 (0.76, 1.99)	.403
Stable home	1.00		-	
Unstable home	1.52 (0.85, 2.70)	.159	, g-	
No cisgender male sex partner	1.00		-	
Cisgender male sex partner only	3.02 (2.33, 3.91)	<.001	**2.18 (1.52, 3.11)**	**<.001**
No sex work	1.00		1.00	
Sex work	3.50 (1.70, 7.20)	<.001	1.93 (0.77, 4.85)	.164
No chlamydia	-		-	
Chlamydia	-		-	
No hormones	1.00		1.00	
Hormones	2.24 (1.58, 3.19)	<.001	**2.56 (1.53, 4.31)**	**<.001**
No gender affirming surgery	1.00		1.00	
Gender affirming surgery	1.59 (1.19, 2.12)	.002	**1.63 (1.10, 2.41)**	**.014**
No substance use	1.00		1.00	
Substance use	3.23 (1.67, 6.24)	<.001	**2.76 (1.23, 5.78)**	**.013**
No syphilis	1.00		-	
Syphilis	1.35 (0.54, 3.39)	.523	-	
No Gonorrhea	1.00		-	
Gonorrhea	1.33 (0.14, 12.52)	.801	-	
No genital warts	1.00		1.00	
Genital warts	3.63 (1.83, 7.20)	<.001	**2.69 (1.20, 6.02)**	**.016**
No Silicone	1.00		-	
Silicone	1.68 (0.93,3.02)	.084	-	

HIV screening in the New York City Community Health Survey

In 2011 the rate of ever having a test for HIV among participants in the NYC CHS who were engaged in care was 58.8% compared to 55.7% of transgender patients, p=.091.

Factors Associated with HIV Status

In the bivariate analysis for transmasculine individuals, HIV-positive status was associated with having a cisgender male partner (OR=5.68, 95% CI 1.02, 31.58). Individuals with at least a high school diploma had reduced odds of being HIV positive (OR=0.07, 95% CI=0.01, 0.49). Age, education and sex partner were placed into the multivariate model and both cisgender male partner (OR=10.58, 95% CI 1.33, 84.17) and high school diploma (OR 0.08, 95% CI 0.01, 0.72) remained a significant predictors of HIV status. Table 9a

For transfeminine individuals the bivariate analysis demonstrated that non-white race, unemployment, having genital warts and a history of silicone use were significantly associated with HIV status. Vaginoplasty surgery (OR= 0.25; 95% CI=0.11, 0.59) and at least a high school diploma (OR= 0.44; 95% CI=0.28, 0.71) were associated with reduced odds of HIV infection. There was a trend to greater odds of HIV associated with sex work and syphilis infection, however these were not statistically significant. In the multivariate analysis unemployment (OR= 1.71;95% CI=1.1, 2.64) a history of genital warts (OR=2.81; 95% CI=1.46, 5.41) were associated with greater odds of HIV infection and white race was associated with lower likelihood of infection (OR=0.40; 95% CI= 0.21, 0.73). Table 9b.

Table 9a: HIV Prevalence: Bivariate and multivariable logistic regression models and transmasculine individuals

Transmasculine				
	Bivariate		Multivariate	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age in years	1.00 (0.92, 1.09)	.977	1.04 (0.93, 1.15)	.522
Non white	1.00		1.00	
White (non-Hispanic)	0.48 (0.09, 2.52)	.383		
Employed	1.00		-	
Unemployed	2.19 (0.48, 10.06)	.315	-	
No high school diploma	1.00		1.00	
High school diploma	0.07 (0.01, 0.49)	.007	**0.08 (0.01, 0.72)**	**.009**
Stable home	-	-	-	
Unstable home	-	-	-	
Insurance	-	-		
No cisgender male sex partner	1.00		-	
Cisgender male sex partner only	5.68 (1.02, 31.58)	.047	**10.58 (1.33, 84.17)**	**.026**
No sex work	-	-	-	
Sex work	-	-	-	
No chlamydia	-		-	
Chlamydia	-	-	-	
No hormones	1.00		-	
Hormones	1.08 (0.13, 9.21)	.946	-	
No Gender affirming care	1.00		-	
Gender affirming care	0.78 (0.09, 6.73)	.583	-	
No vaginoplasty	N/A			
Vaginoplasty	N/A			
No gender affirming surgery	1.00		-	
Gender affirming surgery	0.18 (0.02, 1.49)	.111	-	
No substance use	1.00		-	
Substance use	2.73 (0.31, 24.23)	.368	-	
No syphilis	-	-	-	
Syphilis	-	-	-	
No Gonorrhea	-	-	-	
Gonorrhea	-	-	-	
No genital warts	1.00		-	
Genital warts	3.21 (0.36, 28.81)	.298	-	
No Silicone	-		-	
Silicone	-	-	-	

Table 9b: HIV Prevalence: Bivariate and multivariable logistic regression models and transfeminine individuals

Transfeminine				
	Bivariate		Multivariate	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age in years	1.01 (1.00, 1.03)	.189	1.02 (1.00, 1.04)	.080
Non white	1.00		1.00	
White (non-Hispanic)	0.30 (0.17, 0.52)	<.001	**0.40 (0.21, 0.73)**	**.003**
Employed	1.00		1.00	
Unemployed	2.28 (1.58, 3.27)	<.001	**1.7 (1.1, 2.64)**	**.016**
No high school diploma	1.00		1.00	
High school diploma	0.44 (0.28, 0.71)	.001	0.64 (0.38, 1.10)	.107
Stable home	1.00		-	-
Unstable home	1.80 (0.95, 3.41)	.072	-	-
Insurance				
No cisgender male sex partner	1.00	-	-	-
Cisgender male sex partner only	1.31 (0.90, 1.89)	.160	-	-
No sex work	1.00		-	
Sex work	1.79 (0.99, 3.23)	.055	-	
No chlamydia	1.00		-	
Chlamydia	3.06 (.48, 19.57)	.237	-	-
No hormones	1.00		-	-
Hormones	1.10 (0.62, 1.93)	.749	-	-
No Gender affirming care	1.00		-	-
Gender affirming care	1.26 (.64, 2.47)	.500	-	-
No vaginoplasty	1.00		1.00	
Vaginoplasty	0.25 (0.11, 0.59)	.002	0.45 (0.17, 1.20)	.109
No gender affirming surgery	1.00		1.00	
Gender affirming surgery	0.82 (.56, 1.19)	.292	-	-
No substance use	1.00		-	-
Substance use	1.35 (0.75, 2.41)	.314	-	-
No syphilis	1.00		-	
Syphilis	2.20 (0.96, 5.04)	.063	-	
No Gonorrhea	1.00		-	-
Gonorrhea	0.62 (0.06, 6.22)	.681	-	-
No genital warts	1.00		1.00	
Genital warts	3.72 (2.16, 6.41)	<.001	**2.81 (1.46, 5.41)**	**.002**
No Silicone	1.00		1.00	
Silicone	2.17 (1.17, 4.01)	.013	1.65 (0.72, 3.77)	.239

4.4 Discussion

Baseline Characteristics

The transfeminine and transmasculine individuals attending the Center differed in multiple ways. Transmasculine people were younger, predominately white, more highly educated, more likely to be employed and have stable housing when compared with transfeminine individuals.

Gender Affirming Care

Since some gender affirming procedures can directly impact sexual health and potentially risk of STIs and HIV, understanding the types of surgeries, especially genital surgeries, is essential to providing comprehensive sexual health services to transgender people. In this study uptake of gender affirming hormone therapy was found to be high in both groups, with 79% of transmasculine and 84% of transfeminine people using hormones. Fewer individuals had accessed gender affirming surgeries. In this report 26.2% of transfeminine individuals had accessed any gender affirming surgery compared to 41.6% of transmasculine individuals. The most common surgery for transmasculine people was bilateral mastectomy (39.3%) whereas the most common procedure for transfeminine individuals was breast augmentation (15.3%). The first US Transgender Discrimination Survey was published in 2011, around the same time as this retrospective chart review and included the experiences of 7500 transgender respondents across the USA. Similarly, about 80% of transgender women and 69% of transgender men had accessed hormone therapy. Approximately the same number of transgender men had accessed mastectomy (43%), but the rates of genital surgeries were much higher in the survey - metoidioplasty 4% and phalloplasty 2%. Twenty one percent of transgender women had undergone breast augmentation and 23% vaginoplasty, both higher than reported in this study.[39] It is likely that if this study

were repeated in 2019 that significantly higher numbers of people would have accessed gender-affirming surgeries due to greater availability of surgeons as well as improved insurance coverage.

HIV Screening Behavior

Although HIV testing rates were low, they were similar to the rate seen in the 2011 NYC CHS. HIV testing was more likely to be undertaken by transfeminine individuals, 62% vs. 43%, $p<.001$. A recent study published by the Centers for Disease Control and Prevention (CDC) revealed suboptimal HIV screening rates among 732 transgender women and 451 transgender men who participated in the Behavioral Risk Factor Surveillance System, an annual telephone survey of US adults. The HIV screening of 35.6% and 31.6% ever and approximately 10% in the last year was equivalent to screening rates among cisgender heterosexuals and far lower than the rates seen among cisgender MSM.[256] The HIV screening rates were higher in this study, probably because all individuals were engaged in care and presumably had better access to HIV and STI care services. For transmasculine individuals. HIV testing was associated with receipt of gender affirming care (hormones and/or surgery), substance use and genital warts in the multivariable analysis. HIV screening among transfeminine individuals was more likely to occur among non-white individuals (also seen in the CDC study), those with cisgender male partners, receipt of gender affirming hormones and surgery, substance use history and genital warts.

The finding that gender affirming care was associated with increased screening is important. It may be because individuals engaged regularly in care (hormone care visits usually occur every 6 months) and therefore have more opportunities for testing, or it could be that individuals medically affirmed in their gender are more likely to engage in healthy screening behaviors. Before gender affirming surgery, many surgeons will require preoperative HIV

testing, which may explain the higher testing rate in the surgical group. Substance use and genital warts were associated with HIV screening. This could be due to more frequent interactions with medical providers and more opportunities to screen, or a perceived increased HIV risk and offers of screening by medical providers. Having cisgender male partners was associated with increased screening in transfeminine individuals only. It is not clear from these data if transmasculine individuals were offered and declined screening or if screening was never offered. Low rates of HIV screening among transmasculine individuals with cisgender male partners may be due to nondisclosure of sexual practices or that medical providers and patients are not aware of their elevated risk.

HIV Prevalence

This study revealed an elevated HIV prevalence of 28.1% among transfeminine individuals, 10 times higher than among transmasculine individuals. The highest rates occurred in people of color, with a prevalence of 45.6% among those who identified as African American. Over the last 3 decades multiple studies have demonstrated a disproportionate risk of HIV among transgender women and supported the findings in this study.[19, 24, 257, 258] In the US, a recent metanalysis of 88 studies revealed a prevalence of 14.1% (95% CI = 8.7%, 22.2%) among transgender women but was much higher among Africans Americans at 44%.[24] This is also a serious health issue in international settings. A metanalysis that included data from 15 countries reported a pooled HIV prevalence of 19.1% (95% CI 17.4–20.7) in 11,066 transgender women worldwide.[25]

There are fewer data regarding the prevalence of HIV among transgender men. A recent metanalysis that included only 7 small studies estimated prevalence to be 1.2% by self-report and 3.2% laboratory confirmed.[24] There was no breakdown by race or ethnicity in these studies

due the small sample sizes. Data from the US National HIV Surveillance System describing the characteristics of the 2335 transgender people newly diagnosed with HIV between 2009 and 2014 reported that over 58% of the 361 transgender men were African American.[259] These data are consistent with the findings in this report, that the highest prevalence occurred in African American transmasculine individuals (6.8%) followed by Hispanics (3.2%).

Transmasculine individuals with at least a high school diploma had reduced odds of being HIV positive compared with those who had no high school diploma. Having cisgender male sex partners resulted in over a five-fold increase in the odds of HIV-infection. Previous research has demonstrated that transgender men who have sex with cisgender men have higher rates of condomless sex, higher number of sex partners and substance use during sex, that probably contribute to elevated HIV prevalence in this population.[260]

Increased odds of HIV infection among transfeminine individuals were associated with non-white race, unemployment and genital warts. An interesting finding was that vaginoplasty surgery was associated with a 75% reduced odds of HIV infection in the bivariate analysis but lost statistical significance in the multivariate analysis. The OR, although suggestive of a protective effect from vaginoplasty is possibly related to the fact that surgeons often refused to do these procedures in women living with HIV. The association of HIV with genital warts can be explained by both being sexually transmitted as well as human papilloma virus (HPV) infections being more prevalent and persistent in people with HIV, rather than to an etiologic factor. HPV is also frequently isolated from transgender women who have sex with men.[261] It is possible that infection with HPV may be a proxy for increased number of sex partners.

Limitations

There were many limitations to this study, the first being that these were all patients engaged in care at a single community health center that is recognized for their transgender health program. It is likely that these patients were not representative of the transgender adult population in the USA. Although there were two trained chart reviewers, it is possible that data were entered incorrectly or that patients were misclassified. Although an analysis to compare binary and nonbinary identified people was planned, the data were sparse, necessitating collapsing of categories into transmasculine and transfeminine which may have obscured important differences between these groups.

Additional challenges were missing data and incomplete records; in many situations the notes were incomplete and important information of HIV and STI risk factors were missing. It was also not possible to confirm whether data were current, e.g., for insurance data, housing status etc.

There was an extremely low rate of STI screening and very low STI prevalence. The low rate of STIs may have been low due to suboptimal screening practices and/or because the testing that was available did not use nucleic acid amplification testing for gonorrhea testing and instead used culture, which is not as sensitive for detection of gonorrhea.

Lastly, the data used in this analysis came from a chart review done over 9 years ago and it is possible that trends in health care uptake may have changed due to greater accessibility of insurance and health settings willing to provider gender affirming care. The study is still relevant however due to the fact that there have few studies published during this time examining primary

care outcomes, none examining colon cancer screening and none assessing HIV prevalence for transmasculine individuals who exclusively have sex with cisgender men,

4.5 Conclusion

This study of the health care utilization of transgender people was the largest to date conducted at a community clinic in the US. The findings were consistent with many previous observations, such as elevated HIV risk among transfeminine individuals, especially transgender women of color. This current study adds new information by stratifying HIV prevalence among transgender people by the gender of sexual partners. The highest risk occurred among transfeminine individuals who had cisgender male sexual partners (29.8%) and the lowest rates occurred among those with cisgender female partners (10%). This was also reported among transmasculine people, with an overall prevalence of 2.8% that increased to 11.1% among those who had sex exclusively with cisgender men. This is important because the current belief is that transmasculine people have little risk and therefore often are not targeted for HIV prevention interventions. This has important implications for researchers and policy makers who have frequently not addressed HIV vulnerability among transmasculine individuals.

HIV screening has been found to be suboptimal in transgender populations. The finding in this study that screening rates are highest in those receiving gender affirming care suggests that this could be investigated further as part of expanding HIV prevention efforts.

Chapter 5: Dissertation Summary and Conclusions

The aim of this dissertation was to add to the body of knowledge about the state of health of transgender individuals, in particular to describe the utilization of gender affirming medical care (gender affirming hormone therapy and surgeries) and uptake of preventive healthcare among transgender patients. Three studies were conducted. The first was a retrospective chart review that described the characteristics of transgender people in care, the types of gender affirming procedures they accessed and an investigation of preventive care quality measures, specifically colorectal cancer screening using colonoscopy and cigarette smoking that were compared to New York City benchmarks found in the New York City Community Health Survey. The second study was a scoping review of the literature to examine the types of vaginoplasty procedures and associated postoperative complications that can occur, both immediate and long term. The final study was an investigation of HIV and STI screening practices among transgender people that provided predictors of HIV screening and prevalence.

Summary of Results

Chapter Two, the first study, used data obtained from a retrospective chart review of transgender patients in care at a New York City community health center. The purpose was to describe utilization of gender affirming care by transgender patients. In order to do this an algorithm was developed to identity transgender patients that used a combination of ICD codes, medication history and discordant names and gender markers. Once the database was established further analyses could be run to examine the uptake of health care services, transition-related and otherwise. In this chapter, the diversity of gender identities held by transgender people was

highlighted as well as significant differences in baseline characteristics, uptake of gender affirming care and preventive care by transmasculine and transfeminine people

Transmasculine people were younger, predominately white, more highly educated, more likely to be employed and have stable housing compared with transfeminine individuals. Uptake of gender affirming hormone therapy was high in both groups, with 79% of transmasculine and 84% of transfeminine people using hormones however fewer individuals had accessed gender affirming surgeries; 26.2% of transfeminine individuals compared to 41.6% of transmasculine individuals, $p<.001$. Of particular concern was that when compared to predominately cisgender participants in the New York City Community Health Survey, Transgender people had a higher likelihood of smoking (OR=1.92; 95% CI=1.61, 2.28) and transgender individuals 50 years and older were far less likely to undergo colonoscopy, OR=0.16; 95% CI=0.11, 0.23.

This report underscores the need for data about transgender people to be disaggregated by gender identity and not combined as a single "transgender" population in research studies. This study also brings to light a significant disparity in colon cancer screening and supports previous research finding a higher prevalence of cigarette smoking in transgender populations.

Chapter three described the second study, a scoping review of vaginoplasty surgery in transgender women to investigate short and long-term health outcomes related to these surgeries. Gender-affirming genital surgeries are not common and primary care providers and other healthcare workers are likely to be unfamiliar with these procedures and how to provide adequate postoperative follow-up. One hundred and three articles met the inclusion criteria and revealed that despite an increase in the number of studies published over time, many were low quality descriptive studies and there were no uniform measures of outcomes, which ranged from postsurgical complications to measures of function, esthetics and quality of life. Thirty-six of the

studies were case reports that demonstrated that serious complications can occur decades after surgery - one woman presented with problems well over 4 decades after her vaginoplasty procedure. There is a need to develop standardized outcomes that can be replicated across studies.

Chapter 4 described the third study in the dissertation which had the aim to describe the prevalence of HIV and sexually transmitted infections (STIs) among transgender clients attending a New York City Health Center and to investigate HIV and STI screening practices. The hypothesis was that there would be distinct differences in the prevalence of HIV and STIs between transgender men and transgender women and more importantly to add to the sparse data regarding HIV risk in transmasculine individuals. Several important findings were seen. Firstly, the study supported what is currently know about HIV in transfeminine individuals, showing HIV prevalence of 28.1%, with highest rates among those who identified as African American (45.6%). Among transmasculine individuals the HIV prevalence of 2.8% was within the range previously reported in the literature. What was new was the ability to show that HIV prevalence was higher among those with cisgender male partners only, 11.1%. Transmasculine individuals with cisgender male partners were almost 11 times more likely to be HIV-positive, OR=10.58; 95% CI 1.33, 84.17). Another key point was the association of gender affirming surgeries with HIV and STI prevalence. One of the research questions was to investigate the prevalence of STIs among people who had undergone genital surgery. Transfeminine people who had undergone vaginoplasty were compared to those who had not. The rate of genital warts was lower in those who had surgery (6.7% vs. 0%, p=.002) and there was also a statistically significant lower prevalence of HIV among those who had vaginoplasty (30% vs. 9.7%, p<.001). Having gender affirming surgery was also associated with improved HIV screening rates for both

transmasculine (OR=1.67;95% CI=1.08, 2.58) and transfeminine individuals (OR=1.63;95% CI=1.10, 2.41). Although the association between surgeries and lower HIV/STI prevalence and improved screening maybe a marker of better engagement in care and surgical restrictions, it raises the possibility that access to gender affirming procedures improves other health outcomes.

Strengths and Limitations

The analysis of this dissertation provided some key strengths. Firstly, data on 1670 transgender people makes it one of the largest single site studies on transgender health in the USA. In addition, as the site was a federally qualified health community health center in an urban area, the population was more racially and ethnically diverse than seen in similar studies done in Europe.

There were many limitations to with this dissertation, the first being external validity. The data used for the studies in Chapter 2 and 4 were from a single center, albeit a center serving the largest number of transgender patients in the country. It is highly likely that these patients were not representative of the transgender adult population in the USA, or even other transgender people in New York. The patients in care at CLCHC had access care regardless of ability to pay, and were readily prescribed hormones. This experience alone is unlikely to be replicated nationally.

Although there were two trained chart reviewers, it is possible that data were entered incorrectly or that patients were misclassified. Many of the data points, especially for substance use were incomplete. Unfortunately, there were insufficient data on mood disorders, such as anxiety and depression, so these could not be included in the analyses that investigated primary care outcomes and HIV/STI risk.

It was not possible in these studies to disaggregate the separate outcomes of nonbinary identified people as the data were sparse. This led to the collapsing of categories into transmasculine and transfeminine which may have obscured important differences between these groups. When reviewing the possible reasons for the invisibility of nonbinary identities it became clear that this was one area where the timing of the study (the chart review was mostly covered information from 2010) could have impacted disclosure of identity. Guidelines in use at the time restricted gender affirming surgeries to transgender people with binary identities. It is likely that some non-binary identified people stated they were trans men or women in order to access these gender-affirming procedures.

There was an extremely low rate of STI screening and very low STI prevalence. The low rate of STIs may have been low due to low screening prevalence and/or because the testing that was available did not include nucleic acid amplification testing for gonorrhea. It was not possible to compare STI screening among cisgender individuals or with NYC benchmarks as this was not a question that was included in the NYC CHS. It was not possibly to investigate any aspect of STIs in transmasculine people due to this extremely low prevalence.

There were important variables that were not collected during the chart review, such as mental health diagnoses, psychotherapeutic interventions and social support. These can all impact on HIV and STI risk and would have improved interpretation on results.

Lastly, the data used in this analysis came from a chart review done over 9 years ago and it is possible that trends in health care uptake may have changed due to greater accessibility of insurance and health settings willing to provider gender affirming care. The study is still relevant however due to the fact that there have no few studies published during this time examining

preventive care and there are still large gaps in knowledge about HIV and STI risk among transmasculine individuals.

Public Health Implications

There are several public health implications resulting from this dissertation. The first issue, and possibly most important, is that in order to investigate health outcomes among transgender people, gender identity needs to be uniformly collected, not only in electronic health records (EHRs) but also in large data sets and national health surveys, such as The National Health and Nutrition Examination Survey (NHANES) and The National Health Interview Survey (NHIS).

Second, public health programming, especially for HIV and STI prevention, should focus efforts on risk and not just gender identity. Currently most of the HIV prevention efforts for transgender people have been for transgender women however this dissertation has shown that transmasculine individuals who have sex with cisgender men, have a 10-fold greater prevalence of HIV compared with those without cisgender male partners, and need to be prioritized in HIV prevention programming, including behavioral and biomedical interventions, such as HIV pre-exposure prophylaxis.

Future Research Agenda

This dissertation highlighted many areas that still need to be studied and the need to create a comprehensive research agenda for transgender and gender non-binary people.

Further research needs to be done to investigate health outcomes in transgender populations. There have been recent attempts to create cohort studies of transgender people, including Trans Pop, the first US national probability sample of transgender individuals (www. http://www.transpop.org/). These efforts need to continue. Other possibilities for creating large datasets include pooling of data from multiple clinics. This will require better methods to identity

transgender people in EHRs, since currently centers capture data on gender identity and birth sex differently, depending on the capability of their systems.

This dissertation revealed that receipt of medical gender-affirmation may influence promotion of healthy behaviors, such as HIV screening. Future research should be undertaken to understand the effect of gender-affirming interventions on health outcomes as well as to understand the pathways by which this may occur, e.g., through mediation of stigma.

The strategy used in this paper uncovered the fact that misclassification of birth sex occurred in about 6% of transgender patients. Further research needs to be done to understand whether transgender patients who conceal their birth identity experience different health care outcomes compared to those who disclose their birth sex.

The scoping review of vaginoplasty surgeries revealed that little has been done to create outcomes that have been validated for use in transgender populations. With more and more surgeries being done, it is vital to validate surgical outcome measures as well as to investigate the association of gender affirming care with other non-transition related health outcomes.
To conclude, this dissertation has brought new research findings to the field of transgender medicine and has highlighted research gaps that can be explored in future studies.

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